NORTH MANCHURIAN PLAGUE PREVENTION SERVICE

Peking Central Hospital, nearing completion, September, 1917.

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NORTH MANCHURIAN PLAGUE PREVENTION SERVICE

REPORTS (1914—1917)

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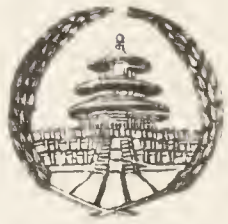

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FOREWORD.

The present Report of the North Manchurian Plague Prevention Service appears at a critical period of the world's history, when China along with her Allies is fighting hard for the cause of liberty and democracy against despotism and militarism.

It is unfortunate that even a humanitarian institution like ours, situated far away from the fighting zone, should have had to undergo so many privations. In the first place, the Russian rouble, upon which the appropriation of the Service has until the last two months been based, has steadily declined in value from $1.20 in pre-war times to 9½ cents Mex. at the present day, thus inflicting untold hardships upon our staff. In the second place, all drugs and hospital necessaries have soared up in price, making the purchasing of materials a matter of the greatest difficulty.

As a result, the savings which we have been able to effect year by year from the regular appropriation in order to meet times of emergency, such as the sudden recurrence of plague, have dwindled down to practically nothing at the present rate of exchange.

Moreover, the increased cost of printing has compelled us to modify our earlier plan of publishing a large and detailed report on the various phases of our work in Manchuria.

In the present volume, only the more important articles, particularly those bearing on investigations in plague and other matters throwing a new light on the medical situation in China, have been inserted.

It is hoped that the publication of these articles in a compact form may encourage other institutions in China to do likewise and so infuse more enthusiasm for scientific medicine and research into the minds of thousands of colleagues who are now practising in various parts of this large country. An enormous quantity of material—clinical and pathological—is daily wasted for want of proper facilities and encouragement on the part of responsible authorities.

I wish finally to express my great indebtedness to Doctor John Winghon Chun, M.B., B.C. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), my colleague and sympathiser during many anxious moments, for his able collaboration in the preparation of this Report.

W. L. T.

Harbin, December 2nd, 1917.

TRANSMISSION OF PNEUMONIC AND SEPTICEMIC PLAGUE AMONG MARMOTS.

Reprinted from
The American Journal of Infectious Diseases (*Vol. 20. No. 2*),
and the Journal of Hygiene (*England*).

The question of plague transmission among marmots was brought up at the time of the historic epidemic of pneumonic plague which raged in Manchuria during the winter of 1910-1911. The tarbagan, known as Arctomys bobac, was suspected of having played a part in the transmission of the disease, yet no experimental evidence was brought forth to show that this animal was in any way associated with plague. It was not until Strong[1] showed that tarbagans can be infected that we obtained the first important facts concerning the possible importance of these animals in the epidemiology of a dread disease. He demonstrated, in a general way, that they can take pneumonic plague if the organisms are sprayed in droplet form.

The experiments reported here were designed to elucidate this point and to determine the rôle played by the marmot in the spread of infection through contact and feeding on plague corpses.

The animals used were of a species closely related to the tarbagan, known as Spermophilus citillus. These ferret-like animals are very numerous in and about the city of Mukden, especially in the summer season. They frequent the grave yards, burrowing under the ground, not unlike the ground squirrel or American gopher. In size they approximate the rat. They are vicious, making good use of their long and exceedingly sharp teeth and claws They can be easily trapped by pouring water into the burrows and catching them as they rush out to escape suffocation. With careful handling, they may live in captivity for a long time.

INHALATION EXPERIMENTS.

The method of inoculation was made to conform as far as possible with the natural mode of infection with pneumonic plague.

A 24-hour-old agar slant culture of a moderately virulent strain of B. pestis was suspended in 10 c.c. of salt solution and sprayed from a graduated cylinder fitted with a very fine nozzle. Great care was taken to direct the spray in

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* The experiments here summarized were conducted at Mukden Medical College, to the staff of which we are greatly indebted for their kindness and courtesy in giving us facilities for our work.

[1] Philippine Jour. Sc., 1912, 7. 225. Report of the International Plague Conference, Mukden, 1911.

a fine cloud towards, but not into, the nasal passage. Altho a definite amount of culture was used in the two series of experiments, it was not possible to determine more than roughly, if at all, how much of the culture found its way into the respiratory tract. In the first series, 5 minims were sprayed and in the second, 10. A great portion of the spray obviously failed to inoculate, both because of the mechanical difficulties entailed in the technic and because of the position of the animals on the stage. It was necessary to clamp the neck in order to hold them down properly, so that in many instances normal breathing was out of the question. The errors due to the loss of most of the culture spray tend to make these results all the more striking. Before the spraying, the animals were covered with a wide piece of absorbent cotton soaked in cresol, to prevent droplets lodging on the fur, and after inoculation the head of each marmot was carefully wiped to remove extraneous organisms. In order to minimize the danger from droplet infection, a specially constructed box was used while the animal was being inoculated. This box enabled the operator to place the animal and stage in a compartment which had a glass top and which permitted of inoculation through an opening at the front end of the box. This aperture was at the level of the animal's head as it lay fastened on the stage and the spray, directed through the opening, reached the nose readily.

SERIES 1

In Series 1 the animals were placed in fleaproof cages, 9 by 15 by 20 inches, separated from the normal animals in some instances by a single partition, and in others by a complete four-walled screened compartment which stood in the center. The latter type of cage was used so that the normal animals might run about the central compartment and thus come in freer contact. Five minims were sprayed.

Experiment 1.—Two marmots were inoculated and 2 contacts placed in the adjoining compartment on the same day.

Both the treated animals failed to take plague. They were killed on the 20th day. No changes were noted in the organs, and smears from these were entirely negative. Of the two contacts, one died after 12 days There were signs of inflammation in the lungs with congestion, and enlargement of spleen and liver; smears from these organs were negative. The second contact was killed after 21 days. No changes were observed in the organs, and smears from the organs and a blood culture were negative.

Experiment 2.—Two marmots were inoculated and screened from 4 normal animals placed in contact on the same day.

Contact 1 died after 7 days. Lungs inflamed, liver enlarged, spleen friable and necrosed, trachea and bronchi inflamed. Smears from heart, lungs, liver, and spleen showed great numbers of plague bacilli. A blood culture yielded B. pestis, and when injected in small amount into a normal marmot, it killed the animal in 48 hours with typical septicemic plague. Contact 2 died after 12 days. Organs congested, lungs severely involved, and the pleural cavity markedly inflamed. Bronchial inflammation marked. Smears from organs and blood positive for B. pestis. Contacts 3 and 4 died after 2 days with no morbid signs whatever.

Inoculated Marmot 1 died after 12 days with typical pneumonic and septicemic plague. Smears from organs and blood yielded great numbers of bacilli. Marmot 2 was killed after 18 days. No changes noted in the organs. Smears entirely negative.

In this experiment it is interesting that a contact succumbed 5 days before any of the inoculated animals died, and that of the latter two, one lived for 12 days while its mate, confined in the same cage, failed to take plague. It is very evident that here, as is the case among men, a difference in resistance must prevail. Apart from this we must take into account the different factors which tend to modify the chances of infection even by close contact.

Experiment 3.—Two marmots were inoculated and placed in the central compartment. Two normal contacts were placed in the cage after one day.

The contacts were both alive and well on the 22nd day.

Inoculated Marmot 1 died after 10 days with typical pneumonic plague. Congestion of the organs and viscera, and enlargement of liver and spleen. Smears from blood and organs showed B. pestis. Marmot 2 was alive and well after 22 days.

Here we have another instance of chronic plague in which the animal lived beyond the ordinary 3-6 days after infection.

Experiment 4.—Three marmots were incoulated and placed in a central compartment as in the preceding experiment. Two normal animals were put into the surrounding space after 2 days and were then removed after being in contact for 5 days.

Contact 1 died after 15 days. Lungs showed s'ight inflammation and congestion; liver and spleen unchanged. Smears from organs and blood culture negative. Contact 2 was alive and well after 22 days.

Inoculated Marmot 1 died after 5 days. Typical pneumonic plague. Liver greatly enlarged, spleen congested and friable, kidneys inflamed, cervical glands enlarged. Smears from blood and organs showed enormous numbers of plague bacilli. Marmot 2 died after 7 days. Lungs completely inflamed and congested; liver enlarged, friable, congested; spleen friable, hemorrhagic; kidneys pale, with petechiae. Smears from heart were negative, as were those from the spleen. The lungs showed great numbers of bacilli and a few were noted in the spleen tissue. Marmot 3, like the first, died of pneumonic and septicemic plague after 7 days.

Experiment 5.—Three marmots were inoculated and placed in a central compartment. After 3 days 2 normal animals were put into the surrounding space.

Contact 1 died after 3 days. Lungs inflamed; no changes in other organs. Smears from blood and organs and blood cultures negative. Contact 2 died after 7 days. Inflammation of lungs, enlargement and congestion of organs. Trachea and bronchi somewhat inflamed. Smears from organs and blood contained numerous plague bacilli.

Inoculated Marmot 1 died after 5 days. Lungs congested, acute double pneumonia. Liver and spleen enlarged, congested, and friable Kidneys slightly inflamed and congested. Trachea and bronchi involved. Smears from blood and organs showed B. pestis, the greatest number being present in the spleen. Marmot 2 died after 7 days. Typical pneumonic and septicemic plague. Visceral congestion marked and the blood vessels engorged. Smears from the organs and blood showed enormous numbers of bacilli, the spleen being a solid mass of B. pestis. Marmot 3 died after 7 days. Postmortem findings were the same as in 2.

This first series of experiments indicates that pneumonic plague can be transmitted to the marmot rather readily and that these animals, in turn, are capable of transmitting the disease to others. In one of these experiments (5), it should be noted that one animal was able to infect a normal animal at least as early as 2 days after inhaling plague bacilli. From the results obtained in this set of experiments it is evident that the chances for infection by contact were minimized by the method of housing the animals, and the positive cases which resulted are therefore all the more surprising. Of 12 animals inoculated by inhalation, 8 died of typical plague pneumonia in from 3 to 7 days on an average. Of the contacts, 3 died and 7 survived. The percentage in the first instance is 66.6 and in the second, 30. Fifty percent of the animals which were exposed either directly or indirectly to the discase, died.

In order to insure more natural living conditions, such as normally prevail among these animals, a second series of experiments was conducted with the contacts placed in unscreened cages. Careful examination had already revealed the fact that fleas were

very scarce on the marmots, and whatever insect transmission might occur, would be easily recognized from the resultant type of plague. This phase of the problem is now being studied and will make the subject of a separate report.

SERIES 2

Experiment 1.—Two marmots were inoculated. Three contacts were placed in the same cage after 24 hours.

Contact 1 died after 5 days. Lungs were inflamed throughout and contained fibrinous exudate. Liver and spleen markedly enlarged, congested, and stippled. Kidneys enlarged and inflamed. Trachea and bronchi inflamed. Smears showed numerous B. pestis in lungs, liver, and blood, and enormous numbers in the spleen. Contact 2 died after 12 days. Postmortem findings same as in 1, with additional pronounced visceral congestion. Smears from the organs showed numerous bacilli, with the greatest numbers in the lungs. The heart blood was negative in smear preparation, but yielded a pure culture on agar. Contact 3 died after 12 days. Postmortem findings were similar to those described. The greatest number of plague bacilli were present in the lungs.

Inoculated Marmot 1 died after 3 days. Typical plague pneumonia. Congestion and enlargement of spleen and liver. Smears from organs showed bipolar organisms and a few large rod-shaped bacteria. A culture from the heart blood was injected subcutaneously into a normal marmot and death ensued within 2 days from acute septicemic plague. Marmot 2 died after 9 days. Typical plague pneumonia and septicemia. Organs enlarged and congested. Visceral congestion marked. Plague bacilli present in enormous numbers in all the organs.

Experiment 2.—Two marmots were inoculated. Two contacts were placed in the same cage after 2 days.

Contact 1 died after 4 days. Lungs inflamed throughout and congested. Spleen and liver enlarged and congested. Visceral congestion pronounced. Trachea and bronchi inflamed. Smears from organs and spleen showed numerous plague bacilli. Contact 2 died after 6 days. Postmortem findings the same as in 1. Smears from blood and liver negative. Numerous B. pestis in lungs and spleen.

Inoculated Marmot 1 died after 5 days. Lungs involved in upper lobes. Liver enlarged and necrotic. Spleen slightly enlarged, but not changed in appearance. Trachea and bronchi inflamed. Smears from lung showed enormous numbers of organisms. Marmot 2 killed after 17 days. No changes noted in the organs. Smears from blood and organs entirely negative.

In this experiment, as in Experiment 2 of the first series, we have another striking example of individual difference in susceptibility. Three animals died of acute plague in from 3 to 6 days respectively, yet the fourth marmot which was exposed to droplet infection and also kept in close contact for the entire period, survived. Moreover, a contact animal died a day sooner than the first of the inoculated marmots. It is important to bear in mind, however, that the methods of infection are different in each instance. A contact animal would in all likelihood receive a greater number of plague bacilli from the infective animal. Assuming that the dose thus received is equal to, or even less than that which was given to the inoculated animal, we must take into consideration the enhanced virulence of the culture as a result of passage through the host.

Experiment 3.—Two marmots were inoculated. Two contacts were placed in the same cage after 3 days.

Contact 1 died after 5 days. Lungs inflamed and greatly congested. Spleen and liver enlarged and congested Inflammation of the bronchi and trachea marked. Smears from organs and blood showed enormous numbers of B. pestis. Contact 2 died after 6 days. Lungs inflamed and congested. Trachea and bronchi inflamed. Pronounced visceral congestion and engorgement of vessels. Smears from blood and organs yielded enormous numbers of bacilli, particularly in the spleen and lungs.

Inoculated Marmot 1 died after 5 days. Lungs slightly inflamed with involvement of upper lobes. Liver enlarged and slightly necrosed. Spleen somewhat enlarged. Bronchi involved. Smears from blood and organs showed enormous

numbers of plague bacilli. Marmot 2 died after 6 days. Typical plague pneumonia. Marked visceral congestion. Greatly enlarged spleen. Congested liver. Smears from organs and blood contained numerous plague bacilli.

Experiment 4.—One marmot was inoculated. Two contacts were placed in same cage after 4 days.

Contacts 1 and 2 alive and well after 16 days.

Inoculated Marmot 1 died after 15 days. No marked changes in lungs or liver. Spleen slightly necrosed. Smears from heart blood, lungs, liver, and spleen negative. Culture from heart negative.

A summary of the results obtained in this series of experiments shows in a conclusive manner that plague-infected marmots can readily transmit plague through the breath as is the case among men. Conditions which favor the propagation of the disease among the latter are in no way different for these animals. Close contact and moist surroundings seem to favor rapid spread from animal to animal. Of 7 marmots inoculated by inhalation, 5 died after from 4 to 6 days with acute pneumonic plague and septicemia—a percentage of 71. Nine contacts placed with infected marmots after periods varying from 1 to 4 days, showed a mortality of 77% These 7 marmots died, on an average, after from 4 to 6 days' contact. Here, also, as in the preceding series, there was noted a remarkably short incubation period, with marked early infectivity on the part of the inoculated animals.

The postmortem findings indicate very clearly that pneumonic plague in marmots is not unlike that in man. The bacilli, entering the respiratory tract, lodge in the lungs and from this primary focus go over into the circulation to cause a generalized septicemia. Most striking are the gross pathologic changes in the organs, chiefly the lungs. Extreme congestion and inflammation with fibrinous exudate characterize the latter, and associated with this is pronounced inflammation of the pleural cavity. Enlargement of the spleen and liver is frequent, tho not constant, and visceral congestion is prominent. No instances of axillary or inguinal gland-involvement were observed, altho in a few cases the cervical glands were enlarged and upon microscopic examination of smears, showed plague bacilli in goodly numbers. Inflammation of the trachea and bronchi occurs with marked regularity.

Bacteriologic examination demonstrated that altho the lungs may contain enormous numbers of bacilli, yet this organ is not exclusively selective. In a fair proportion of cases in which the lung had few organisms, the spleen invariably teemed with them. This was also noted when blood smears were not particularly full

of B. pestis. The number of organisms present in any one organ at a given time seems to depend on a variety of circumstances, not the least of which appears to be the resistance of the animal in question. Some animals, it was noted, may evidence a distinct toxemia without marked bacteriemia. In analogous fashion, a few of the marmots may offer such low resistance to the disease that they succumb to it before any very marked changes appear in the organs.

Of great interest is the fact that plague may exist in chronic form among marmots. That they can live for 9 or 12 days with pronounced plague and be capable of conveying infection to other animals, is a fact of the utmost importance from an epidemiologic standpoint.

SUSCEPTIBILITY TO INFECTION.

Plague septicemia, as seen, results readily from plague pneumonia. In order that we might study the susceptibility of marmots to this type of plague, a number of animals were inoculated subcutaneously with varying doses of bacilli. All the animals died of acute septicemic plague with slight, if any, signs of bubonic infection. That these animals are very susceptible to plague septicemia follows from this experiment. The culture used was only moderately virulent and had been growing on agar for several generations. A 72-hour growth on small agar slants was used for inoculation. Animals numbered 6 to 10, inclusive, were inoculated with the same strain after it had passed once through a marmot.

Marmot	Dose (slant)	Result	Postmortem Findings
1	1/20	Death, 2 days	In all intense congestion at site of inoculation. Spleen and liver enlarged and congested. Smears from blood and organs showed enormous numbers of plague bacilli.
2	1/40	Death, 2 days	
3	1/80	Death, 6 days	
4	1/40	Death, 4 days	
5	1/80	Death, 5 days	
6	1/80	Death, 36 hours	
7	1/80	Death, 36 hours	
8	1/80	Death, 48 hours	
9	1/80	Death, 48 hours	
10	1/80	Death, 48 hours	

PLAGUE TRANSMISSION BY FEEDING.

Experiment 1.—Three marmots were fed with liver and spleen taken from a guinea-pig which had died of plague after 56 hours.

Marmot 1 died after 3 days Liver and spleen congested Stomach inflamed. Smears from lungs, liver, spleen, and blood showed B. pestis. A blood culture, injected into a normal marmot, killed the animal within 36 hours, the autopsy showing acute plague with B. pestis in all the organs and blood Marmot 2 died after 3 days. This animal was eaten by the third marmot before a postmortem examination could

be made. Marmot 3 died after 4 days. Slight visceral congestion. Inflammation of the gastric mucosa. Smears from blood and organs showed B. pestis. Stomach scrapings were full of plague bacilli.

Experiment 2.- Three marmots fed with lung, liver, and spleen taken from a marmot which had died of acute plague.

Marmot 4 died after 2 days Congestion of liver and spleen. Marked visceral congestion and intense inflammation and congestion of the gastric mucosa. Smears from organs and stomach lining showed great numbers of plague bacilli. Marmot 5 died after 4 days. Liver and spleen congested and enlarged. Visceral congestion marked. Gastric mucosa intensely inflamed. Smears from blood and organs gave enormous numbers of B. pestis. Marmot 6 killed after 14 days. Postmortem examination showed no changes in any of the organs or glands. A very slight area of old inflammation was noted in the gastric mucosa. No organisms could be demonstrated in smears from blood or organs. This animal had been fed twice with plague material with an interval of 1 week between feedings.

This series, tho small, demonstrates that marmots may transmit plague by feeding on plague carcasses. The animals are carnivorous and eat their own mates as soon as death supervenes. Death, by feeding, takes place within 4 days, and is apparently not hastened by greater amounts of ingested plague-infected material. The most striking change in the animal body is noted in the stomach, where intense inflammation of the gastic mucosa occurs The spleen and liver show the usual changes attendant on plague.

That individual differences in susceptibility may exist, is well exemplified in the case of Marmot 6, which failed to take plague, tho it had been given a large amount of highly infected material.

MICROSCOPIC EXAMINATION.

The experiments on the small marmot (Spermophilus citillus) mentioned, particularly which regard to pulmonary plague infection by contact, are perhaps the first that have been recorded. The feeding experiments are especially interesting because many workers, including Strong, have denied the possibility of plague transmission by that means. The histologic changes observed in the lesions of human pulmonary plague have been fully described by various writers, including Albrecht and Ghon[2] (1898-1900), Childe[3] (1898), Strong[1] (1912), Fujinami[4] (1912), and Wu Lien Teh and Woodhead[5] (1913). We preserved and examined a considerable number of specimens from the animals used in these experiments, but as the microscopic changes in the inhalation experiments

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[2] Centralbl. f. Bakteriol, 1899, 26, p. 362.

[3] Brit. Med. Jour., 1897, 1, p. 1215; 1898 2, p. 858.. Report of Indian Plague Commission, London, 1900.

[4] Report of the International Plague Conference, Mukden, 1911.

[5] Jour. Path. and Bacteriol., 1913, 19, p. 1.

differ in no material way from those already described in the case of human pulmonary plague, we shall refer to them only briefly.

Lung.—In acute pulmonary plague (*i.e.*, when the animals died in from 2 to 5 days after infection), sections of the lung showed intense congestion of the blood vessels. The part of the lung tissue adjacent to the pleura was marked by much leukocytosis and even hemorrhage, and areas of collapse could be seen. The small bronchi were filled with mucoid substance, and some were practically choked with pure growths of plague bacilli. Around the inflamed bronchi and bronchioles were patches of pneumonia, harboring numbers of bacilli in the capillaries and alveoli. No fibrinous lymph coagulum was noted.

In specimens obtained from 2 cases which had died 12 days after contact with infected animals the lung tissue showed somewhat different changes. Here hemorrhage and congestion were not so marked, and broncho-pneumonic patches were scanty. The alveoli displayed extensive signs of collapse, and the bronchi signs of inflammation and thickening. Plague bacilli were not nearly so numerous as in acute plague.

Liver.—In the acute form, sections of the liver showed a picture of acute red atrophy, the central lobular vein being much distended, and the portal capillaries swollen. The hepatic cells were markedly "cloudy" and granular, but vacuolation, except in a few areas had not set in earnestly. Hemorrhages were noted everywhere.

In specimens obtained from the chronic cases, the liver substance showed very characteristic signs of degeneration. The central lobular vein was not so distended, and hemorrhage was not so marked. A large portion of the hepatic cells appeared to have lost their contents, so advanced was the vacuolation and loss of nuclear substance. In fact. the whole section stained badly with hematin. Plague bacilli were seen with difficulty.

Spleen.—Here also the changes observed in the acute and chron c disease were characterized by much more congestion in the former than in the latter. The number of bacilli encountered was also greater in the acute form, and the Malpighian bodies were larger and stood out more distinctly.

Kidney.—As in the case of the liver, the kidney showed far more extensive signs of degeneration in the chronic, than in the acute cases. There was very little thickening of the capsule in

either case, but the glomeruli were swollen considerably. In the chronic cases the cells of the tubules had lost the greater part of their substance, and in several places only the basement membrane was seen, so great had been the disintegration. More hemorrhage was noted in the kidney than in other organs in the chronic cases.

Heart.—The muscular tissue showed edematous changes, the striations being more indistinct than usual, and the muscle fibers broken in cases.

Lymphatic Glands.—Both cervical and inguinal glands were examined, but no changes were shown other than those hitherto described in ordinary plague. Organisms were present in lesser numbers than in bubonic plague, and, in the chronic form, were sometimes not seen at all.

Stomach.—So many observers have denied the existence of infection by the alimentary canal that a little more attention may be devoted to the changes observed in this organ. As stated in the preceding section, of 6 marmots fed on plague-infected viscera 5 died—4 definitely of plague, the 5th being eaten by its fellows before an examination could be made. The one animal which survived, after 14 days was killed; it showed no signs of infection. Postmortem examination in all cases was made within a few hours after death. The stomach in all the infected animals showed definite signs of acute inflammation which was most marked at the pyloric end and commencement of the duodenum. Red patches, denoting hemorrhage, and small areas of disintegration were clearly seen. Pieces of the stomach at the pyloric end were removed from Cases 4 and 5, and prepared for microscopic examination. Formalin was used as fixing agent, and the paraffin sections were stained both with alum hematin plus eosin, and dilute Giemsa, as follows: Stain in dilute Giemsa (1 part Giemsa Grübler solution in 10 parts distilled water) for 6 hours. Decolorize in weak acetic acid (5 drops in 100 c.c. distilled water). Wash in distilled water. Blot and clear in xylol. Plague bacilli, when present, are stained deep-blue in the tissues by this method.

The gastric mucosa showed marked changes under the microscope. The mucous glands were intensely inflamed, and hemorrhages could be seen both inside and around them. Clots with fibrin were also encountered, sometimes firmly adherent to the underlying glands. At places large areas of glandular tissue had given way, revealing open ulcers with much leukocytic in-

filtration and ruptured blood vessels around the edges. Apparently the large oxyntic cells were first cast out, for here and there numbers of them were found on the surface intermixed with leukocytes. In other parts, where disintegration had been extensive, only granular debris was left. The cells of the glands were swollen and granular, and where inflammatory changes were most marked they appeared broken up. Plague bacilli were met with in varying numbers amidst the glands, and were most evident on the surface of the necrotic areas. The submucous coat was thickened, the blood vessels supplying the glands being much distended and filled with corpuscles. The inner circular muscular coat was also congested, and large clumps of plague bacilli were seen distributed among the fibers, especially in the neighborhood of blood vessels. The fibers themselves appeared swollen, but no signs of disintegration could be made out. The outer longitudinal muscular coat seemed also swollen, but very few bacilli were met with in this region. The peritioneal coat was slightly infiltrated in certain parts.

In the sections obtained from Marmot 5, the surface of the mucous coat seemed to be largely covered with an organized coagulum of mucoid tissue of varying thickness. Where the clot had broken off, the mucous glands showed necrotic changes similar to those described, and the surrounding blood vessels were greatly distended. Plague bacilli were present in large numbers both inside and outside the clot, and in the granular debris of the mucous glands.

SUMMARY AND CONCLUSIONS

First Series		Second Series	
Animals inoculated.....12	Deaths... 8	Animals inoculated..... 7	Deaths... 5
Contacts.....10	Deaths... 3	Contacts..... 9	Deaths... 7
Total 22	11	Total 16	12

Animals exposed to plague.....38

Deaths.....23

Of the marmots placed in contact with marmots which had received inoculation by inhalation, 52.6% developed pulmonary plague and died on an average within from 4 to 6 days.

Early infectivity on the part of the inoculated animals and a short incubation period characterize the transmission.

Pulmonary plague can be transmitted readily to the small marmot (Spermophilus citillus), and these animals are capable, in turn, of transmitting the same disease through the respiratory passages.

Septicemic plague can be developed in marmots very easily as a result of respiratory infection, and also by direct subcutaneous inoculation with small amounts of culture.

The marmot can take plague by way of the alimentary tract and can spread the disease by feeding on plague-infected carcasses. The microscopic lesions observed in these cases are characteristic.

WU LIEN TEH and
FREDERICK EBERSON.

PLAGUE POISONS AND VIRULENCE

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(Vol. 20 No. 2, 1917.)

The brief note here given represents a few experiments which were made incidental to a study aiming at immunity to septicemic and pneumonic plague.

Friedberger[1] discovered that powerful poisons could be produced if complement, as present in normal guinea-pig serum, was allowed to act on suspensions of bacteria. These poisons, or "anaphylatoxins," as he named them, give acute shock on injection and cause the death of the animal. Recently Zinsser[2] showed that animals may acquire distinct tolerance of such poisons and survive large doses of the "proteotoxins" without evidencing any noticeable shock after the preliminary dose, which is so measured as to give a slight shock to the animal. It was also demonstrated that these products apparently possess aggressinlike properties, which, if injected in combination with sublethal doses of bacilli, such as typhoid bacilli, cause death through a resulting bacteriemia.

In these experiments I have tried to obtain Zinsser's proteotoxins from plague bacilli in an attempt to immunize animals with this poison. Contrary to results obtained with other organisms, it was impossible to develop a poison which would give the slightest shock when injected intravenously. Curiously enough, all the animals so treated died of acute plague after several days. Postmortem examination revealed the presence of plague bacilli in great numbers in the blood and organs. Evidently the few bacilli which remained in the supernatant fluid after prolonged centrifugation of the serum plus the organisms, had become more virulent and an aggressive action, as noted by Zinsser, had occurred.

The culture used in these experiments was an avirulent Shanghai strain of B. pestis that had been growing on artificial media in this laboratory for 1½ years. The method of procedure was, in general, as follows: An 18- to

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[1] Berl. klin. Wochenschr., 1910, 47, pp. 1490, 1922.

[2] Jour. Exper. Med., 1914, 20, p. 387.

24-hour old culture, grown on agar, was washed off with 1 c.c. of salt solution and incubated with normal guinea-pig serum for various periods at 37 C. At the end of these periods the emulsions were centrifugated at high speed for 1 hour of more, and the supernatant fluids injected intravenously into guinea-pigs.

Experiment 1.—A 24-hour-old culture was incubated with guinea-pig serum (10 c.c.) for 3½ hours.

Guinea-Pig	Weight	Dose	Result
1	432 gm	1.0 c.c.	No shock. Died after 7 days. Organs and blood full of plague bacilli.
2	411 gm.	0.5 c.c.	No shock. Lived.
3	423 gm.	2.0 c.c.	No shock. Died after 6 days. Same as 1.

In this experiment no shock was produced with doses varying from 0.5 to 2 c.c. Since the incubation period used here seemed rather short, Experiment 2 was made.

Experiment 2.—An 18-hour-old culture of B. pestis was washed off with 1 c.c. of salt solution and incubated with 6.5 c.c. of normal guinea-pig serum for 5½ hours.

Guinea-Pig	Weight	Dose	Result
1	310 gm.	2.0 c c	No shock. Died after 4 days with acute plague. All organs and blood contained enormous numbers of bacilli.
2	365 gm.	2.5 c.c.	No shock. Died after 5 days. Plague bacilli in all organs and blood.
3	295 gm.	1.5 c.c.	No shock. Died after 5 days. Acute plague as in 1 and 2,

A longer incubation period had no effect on the production of bacillary poison. In Experiment 3 the amount of culture was increased.

Experiment 3.—Two agarcultures, 24 hours old, were washed off with 0.5 c.c. of salt solution, respectively, and incubated with 6 c.c. of guinea-pig serum for 5½ hours.

Guinea-Pig	Weight	Dose	Result
1	198 gm.	1.5 c.c.	No shock. Died after 1 day. No plague bacilli found in smears or in cultures.
2	22[illegible] gm.	2.0 c.c.	No shock. Died after 3 days. Typical plague infection. All organs and blood contained great numbers of B. pestis.
3	276 gm.	2.5 c c.	No shock. Died after 4 days. Same as 2

An increased amount of culture had no effect on the action of complement so far as producing a visible shock was concerned. In this experiment, as in the preceding ones, some of the animals showed symptoms of discomfort and illness. If we remark the accelerated death in this series of guinea-pigs, it seems very likely that the poison was more marked. When we say "no shock," we wish to imply that the animal did not show the usual symptoms attending anaphylactic or anaphylatoxic poisoning, altho in a few instances very slight tokens of illness could be detected. In Experiment 4 a greatly prolonged period of incubation was tried.

Experiment 4.—A 24-hour-old culture was washed off with 1 c.c. of salt solution and incubated with 9 c.c of guinea-pig serum for 16 hours at 37 C. The mixture was centrifugated at high speed for 2 hours and then injected in the same manner as before. A control was incubated with salt solution for the same period and likewise injected.

Guinea-Pig	Weight	Dose	Result
1	243 gm.	3.0 c.c.	No shock. Appeared sick. Died after 36 hours. The subcutaneous vessels engorged. Glands inflamed and enlarged. Spleen enlarged and slightly necrosed. Edema marked. No plague bacilli demonstrated in the blood or organs
2	237 gm.	2.5 c.c.	No shock. Appeared sick. Died within 36 hours. Postmortem findings same as in 1.
3*	267 gm.	3.0 c.c.	No shock. Well. Died after 36 hours. Postmortem findings same as in 1 and 2.

* Control.

Here there is evidence of poisoning. The animals showed all signs of a toxemia and no plague bacilli were found in any of the organs or in the blood. It will be seen, however, that the poison produced did not give any actual shock and that the salt-solution control, moreover, acted exactly like the serum from the treated cultures. These results show, therefore, that in this instance a prolonged incubation period effected autolysis of the bacteria and liberated the endotoxins.

The marked absence of shock in the foregoing experiments did not warrant the supposition that a poison, if at all produced by the action of complement, could by itself exert such strong aggressive action as to kill animals which were injected with exceedingly minute amounts of plague bacilli in themselves not virulent. The few organisms which were not removed by centrifugation could not, by any stretch of the imagination, be held responsible for the death of the animals. In Experiment 5 there is decided evidence that contact with normal guinea-pig serum enhances the virulence of the plague bacilli.

Experiment 5.—A 24-hour-old culture of the avirulent strain used in the preceding experiments was washed off with 1 c.c of salt solution and incubated with normal guinea-pig serum in the proportions of 2.0 c.c. of the bacterial suspension to each 2 c.c. of the serum. At the end of each incubation period the emulsions were centrifugated, the sediment carefully washed in order to remove all traces of serum, and the bacteria resuspended in salt solution. Injections were then given intraperitoneally with graded doses of the organisms.

Guine-Pig	Weight	Dose	Incubation	Result
1	342 gm.	0.2 c.c.	5 hr.	Died within 30 hours of acute plague. All organs and blood contained enormous numbers of bacilli
2	305 gm.	0.2 c.c.	22 hr.	Died after 28 hours. Same findings as in 1
3	510 gm	0.1 c.c.	5½ hr.	Died after 44 hours. Acute plague. Postmortem findings same as in 1
4	576 gm.	0.1 c.c.	5½ hr.	Died after 72 hours. Same as preceding.
Controls				
1	344 gm.	0.1 c.c.	.....	Lived. Well
2	250 gm.	0.1 c.c.	.....	Lived. Well
3	348 gm.	0.2 c.c.	.....	Lived. Well
4	372 gm	0.2 c.c.	.....	Lived. Well
5	380 gm.	0.3 c.c.	.....	Died after 5 days
6	305 gm.	0.4 c.c.	.....	Died after 3 days

In this experiment there is conclusive proof that contact with the serum has enhanced the virulence of the culture. If the control animals are compared with the heaviest test animal, it will be noted that the latter succumbed to at least one-seventh the dose required to kill the former in approximately the same time. This increase in virulence by itself, however, cannot account for the death of the animals treated with plague proteotoxin containing a few bacteria. It is evident that the aggressive action of the poison goes hand in hand with the increase of virulence to bring about the results noted.

These experiments repeated with a virulent strain of plague bacteria, gave identical results except that the animals died sooner after receiving the dose of proteotoxin. Naturally this was to be expected, because the culture was far more virulent and the few remaining bacilli in the guinea-pig serum, when further increased in virulence, brought about an overwhelming septicemia.

Whether or not the same results obtain when sensitized cultures are used, remains to be seen. This phase of the problem is being studied and will make the subject of a separate report.

The advantages possessed by such a poison for immunization purposes become very evident when we consider that we are likely to obtain the active principle of the organism by resorting to such a method. From previous work done in immunity to bubonic plague, we have all reasons to believe that the more nearly we can approximate a virulent, or at least, a living culture for purposes of immunization, the more hopeful will be the results. Strong's method of inoculating with a living avirulent strain demonstrates this point but is open to the objection that a living culture is uncertain, if not dangerous, since one is ignorant as to the fate of such bacilli after they are injected into the human body. The experiments here reported confirm the likelihood of just such an unfavorable outcome. Assuming that contact with a normal serum, under body conditions, stimulates, in a general way, what might occur in the human body, we should not hazard such a method very freely for large-scale immunization. Lustig and Galeotti,[3] and more recently Rowland,[4] have demonstrated the value of active bacillary substances for immunization in bubonic plague. These authors obtained excellent results with their so-called "nucleoproteins" of the plague organism.

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[3] Report of the International Plague Conference, Mukden, 1911.
[4] Jour. Hyg., 1912, 12, p. 344.

The value of plague proteotoxins in pneumonic and septicemic plague is now being studied, and we hope to report on this work in a future communication.

FREDERICK EBERSON.

ON THE NATURE OF PLAGUE PROTEOTOXINS*

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In an earlier communication,[1] it was shown that shock-producing poisons could not be obtained with B. pestis when the organisms were unsensitized, however the proportions of bacteria and complement and the time element were varied. The experiments reported below are an extension of the previous studies and will take up the following phases of the general problem of plague immunity:—

1. Production of powerful poisons by means of *sensitized* plague bacteria.
2. Thermostability of the plague proteotoxins.

Experiment 1.

One agar slant of B. pestis (24 hours) was taken up with 0.5 c.c. of NaCl solution and incubated at 37 degrees C. for one hour with 0.7 c.c. inactivated serum from a rabbit X. which had been injected five times intravenously with B. pestis heated to 60 degrees C. for 30 minutes. This animal received doses of 0.1, 0.2. 0.3, 0.5 and 1.0 agar slant and was bled 10 days after the last injection. The serum-bacteria mixture was centrifugated, the organisms washed once with NaCl solution and then incubated with 10 c.c. fresh guinea pig serum for 14½ hours at 37 degrees C. After one hour's centrifugation, the supernatant fluid was injected intravenously into guinea pigs.

G.P.	Weight	Dose	Result
1	180 gms.	1.0 c.c.	No Shock. Died acute plague after 72 hours.
2	266	15.	Very slight shock (?) Died acute plague after 50 hours.
3	260	4.0	Slight shock (?) Died acute plague after 48 hours.

In this experiment the results were not clear-cut and it seemed as if deficient sensitization was responsible for the failure to elicit typical shock. This supposition is in all likelihood borne out by the next experiment. Here, as in the work reported in a previous

*Read at the Conference of the National Medical and China Medical Missionary Associations, held at Canton, January, 1917.

paper, the few organisms remaining in the supernatant fluid were able to cause death.

EXPERIMENT 2.

The procedure was the same as in the preceding, with exception that 2.0 c.c. of sensitizer were used for 1½ agar slants of a Dairen strain of B. pestis and 1.9 c.c. of the same sensitizer for one slant of a Shanghai strain. The amount of complement used for each culture was 7.0 c.c. and the incubation period 14½ hours.

G.P.	Weight	Dose	Result
1	172 gms.	3.5 c.c.	Severe shock. Typical death in 5 min.
2	150	2.5	Severe shock. Died within 20 hours.
3	144	3.25	Slight shock. Died within 20 hours.
4	148	3.0	Moderate shock. Died within 20 hours.

Definite shock could be produced with B. pestis when the organisms were homologous as well as heterologous with the sensitizer used. In the case of guinea pigs 3 and 4 the Shanghai strain was sensitized with its homologous serum and in 1 and 2 a Dairen strain was used with the rabbit serum which was obtained originally by injections of a Shanghai culture.

EXPERIMENT 3.

In this experiment the proteotoxins were *heated for 30 minutes at 50 degress C.*

Three agar slants of B. pestis were taken up with 0.8 c.c. NaCl and incubated with 3.5 c.c. inactivated serum from rabbit X, for one hour at 37 degrees C. Fifteen c.c. guinea pig serum were incubated with the washed, sensitized bacteria for 14 hours. Injections were made intravenously with the supernatant fluid obtained after one hour's centrifugation.

G.P.	Weight	Dose	Result
1	168 gms.	4.0 c.c.	Severe shock. Died in 6 hours.
2	150	3.5	Severe shock. Died acute plague after 48 hours.
3	142	3.0	Severe shock. Died in 18 hours.
4	151	3.5	Severe shock. Died in 21 hours.

Heating at 50 degrees C. for one half hour does not destroy the shock producing properties of proteotoxin obtained with B. pestis. Guinea pigs 1 and 2 served as controls, unheated material being used for injection.

EXPERIMENT 4.

In this and the following experiments, rabbits were substituted for guinea pigs and horse serum was used instead of guinea pig serum for the production of proteotoxins.

One and one half agar slants of B. pestis were sensitized at

37 deg. C. for one hour with 1.8 c.c. inactivated serum from rabbit X. Ten c.c. normal horse serum were incubated for 14 hours in contact with the washed, sensitized bacteria. After centrifugation, the supernatant fluid was *heated for 35 minutes at 50-51 degrees C.* and injected intravenously.

Rabbit	Weight	Dose	Result
1	567 gms.	5.0 c.c.	Severe shock. Fell to side at once. Dyspnoea, twitching and pawing. Recovered in one minute. Died next day.

EXPERIMENT 4A.

Three agar slants of B. pestis were incubated for one hour at 29 degrees C. with 4.0 c.c. inactivated serum from rabbit X. 20 c.c. normal horse serum were incubated with the sensitized organisms for 16 hours at 26 to 29 degrees C. The supernatant fluid was *heated for 30 minutes at 51 to 52 degrees C.*

Rabbit	Weight	Dose	Result
2	412	2.5	Moderate shock. Fell to side. Dyspnoea, pawing and trembling. Recovered in one minute.
3	297	3.0	Slight shock. Recovered in one minute.

EXPERIMENT 4B.

One and one half agar slants B. pestis used with 2.0 c.c. sensitizer from rabbit X. and incubated for one hour at 30 degrees C. Normal horse serum used—10 c.c. Incubation period—14 hours at 30-31 degrees C. Proteotoxin was *heated for 30 minutes at 60-61 degrees C.*

Rabbit	Weight	Dose	Result
4	345 gms.	2.0 c.c.	Severe shock. On side at once. Dyspnoea and continuous pawing. Recovered in two minutes.

The preceding group of experiments demonstrates clearly that the proteotoxins obtained by the method given are thermostabile. Heating for 30-35 minutes at temperatures ranging from 50-61 degrees C. does not destroy the toxicity or shock-producing properties.

There is a wide range of combinations within which the poisons may be obtained, as is evident from the various conditions of temperature and incubation.

EXPERIMENT 5.

In this experiment heavier animals were used and the results of the previous trials confirmed. Four slants of B. pestis were emulsified in a total volume of 1.0 c.c. NaCl solution and incubated with 5.5 c.c. serum (inactivated) from rabbit X, for one hour at 29

degrees C. Thirty c.c. normal horse serum were used for the complex. The incubation period was 14 hours at 29 degrees C. The proteotoxin was divided in two lots and heated at 50 degrees C. for 35 minutes and at 57 degrees C. for 30 minutes, respectively. The injections, as before, were made into the marginal ear vien.

A.

Proteotoxins heated at 57 degrees C.

Rabbit	Weight	Dose	Result
1	726 gms.	2.4 c.c.	No shock.
2	776	3.2	Moderate shock. On side immediately. Intermittent pawing and twitching. Recovery in two min. Died in 20 hours.
3	587	4.0	Very severe shock. Dyspnoea, continuous pawing and trembling. Recovered in 7 minutes. Died after 6 days with severe emaciation.

B.

Proteotoxins heated at 50 deg. C.

Rabbit	Weight	Dose	Result
1	973 gms.	2.0 c.c.	No shock.
2	883	3.6	Very slight shock. Died after 6 days.
3	680	2.5	Slight shock. Died after 6 hours.

The potency of the poison is well shown in this experiment in which an effort was made to administer doses sufficiently great to induce shock, yet enable the animals to survive. Unless the dose given was well below that required for visible shock, according to the weight of the animal, the outcome was invariably fatal. Death seemed to be due to a slow poisoning. This has been observed in numerous other instances which have been omitted in this report for the sake of brevity.

An analysis of the study here presented indicates that the toxemic manifestations of plague bacteria are of a different nature from those which have been described for other organisms such as the B. typhosus, for example. The most striking feature of B. pestis from the standpoint of poison production is the strict requirement of sensitization. In the case of other bacteria studied, this has never been encountered, to the writer's knowledge. Sensitization has usually hastened the formation of proteotoxins but has not been an indispensible factor in the process, since unsensitized bacteria gave rise to powerful poisons equally as well. The significance of this point does not immediately become appearent, but suggests likely explanations for the mechanism of plague infection, the relationship existing between proteotoxins

and bacterial virulence and the possible importance of an antigen-sensitizer complex in the production of shock.

Up to the present time a great deal of evidence has accumulated to support the belief that the different heat-stable antibodies are fundamentally alike. From the results recorded in the preceding experiments it seems as if we might safely identify such heat-stable poisons with one of these antibodies. Zinsser[2] has shown conclusively that after stated intervals, resistance may be developed to shock, subsequent to a single injection of proteotoxins obtained with typhoid bacilli. If thermostability can be proved for these proteotoxins, it will mean the formulation of a general principle.

The rôle played by sensitizer in the mechanism of shock when B. pestis is used, suggests the likelihood of an antigen-sensitizer complex as the important factor in plague infection. This becomes a point of departure for the idea that bacterial virulence and ability to liberate proteotoxins may be correlated in some instances. In an earlier paper[3] it was shown how B. pestis became distinctly enhanced in virulence after being incubated with normal guinea pig serum. At first it was thought that this phenomenon was limited to treatment with normal serum, but such is not the case, since heated serum had a like action. This has been demonstrated by Rowland[4], also, working with horse serum. The nature of this mechanism has not been defined clearly, if at all, since the function of bacteria in the production of shock has been variously explained. Recent studies by Jobling and Peterson[5] showed that bacteria function by removing the serum-antiferments, thus liberating the ferments normally present in the serum and enabling them to act upon the constituent proteins. This conception of the mechanism of shock does not explain entirely the ability to obtain proteotoxins by means of inactivated sera, as has been shown by Neufeld and Dold[6]; rather, it suggests that the thermostabile substance acts like sensitizer and that the increased "virulence" noted by the writer is to be explained, possibly, by the action of complement upon the antigen-sensitizer complex, after the bacteria have been able to multiply sufficiently by virtue of their increased resistance.

Virulence and the ability to produce proteotoxins, then, seem to be synonymous. The unusual susceptibility of the guinea pig to plague infection falls into line with this conception, possibly. As has been seen, B. pestis becomes more virulent after contact

with serum from this animal. Some substance, in all likelihood normal sensitizer, is absorbed out of the serum and the combination so formed becomes amenable to the action of complement. The ease and rapidity with which proteotoxins may be produced will determine the degree of virulence by which the organism in question may be characterized.

Summary and Conclusions.

Powerful shock-producing poisons can be obtained by allowing normal guinea pig or horse serum to act upon *sensitized* plague bacteria.

The proteotoxins of the plague bacteria are *thermostabile*, resisting prolonged *heating at temperatures ranging from 50-61 degrees Centigrade.*

A wide range exists within which the poisons may be obtained. The essential requirement is sufficient sensitization of the plague organisms.

Proteotoxins are obtainable even after considerable exposures. The average period used in these experiments was 14 hours, exclusive of the hour or more necessary for centrifugation and the time required during subsequent operations.

In several instances a period as long as 18 hours did not preclude the formation of the toxic substances.

The mechanism of plague infecion seems to depend upon a primary sensitization of the organisms, the antigen-sensitizer complex being important for poison production. Virulence, so far as B. pestis is concerned, is probably an altered state of the bacteria to the end that poisons are liberated when the normal serum components are allowed to act upon the newly-formed complex.

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ACTIVE IMMUNITY TO SYSTEMIC PLAGUE INFECTION.

STUDIES IN PLAGUE, IV.

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The problem of plague immunity has from its inception failed to lend itself to experimental methods such as have yielded successful or at least hopeful results where other bacterial infections are concerned.

Our knowledge concerning the mechanism of infectious disease has been increased considerably through the ideas presented on the more complicated phases of anaphylactic phenomena. More recent contributions have dealt with the important part played by certain poisons which are produced in the animal body when the particular bacteria are brought into contact with certain substances in the blood serum. Just as Ehrlich's classic works on the chemical affinity of tissue and drugs have borne fruit in the treatment of syphilis and have opened up an immense field for chemotherapeutic research in other branches, notably pneumonia and tuberculosis—so Friedberger's discoveries in anaphylaxis and anaphylatoxic phenomena, as amplified by Zinsser, suggest the possibility of applying certain principles to infections which have baffled all efforts at obtaining what may be termed immunity or resistance. The literature on anaphylaxis and the complicated phenomena related thereto, is bewildering in its scope and cannot be gone into here except to mention that one of the latest developments—that of anaphylatoxins or "proteotoxins," broadly speaking,—has thrown an entirely new light on the mechanism of bacterial infection. The whole problem of adapting these principles, to specific bacterial invasions would hinge on such points as might lead to the following questions:

Does the organism, in any case, play a specific rôle in the liberation of toxic substances known as proteotoxins?

Would a resistance be established for the particular organism used, if such poisons were employed to build up a proteotoxin immunity?

As to the specificity of proteotoxins, *per se*, much has been adduced to indicate that similar toxic products may be obtained by non-specific methods, yet these findings, it seems, serve to the give a broader significance to the biological principles involved and do not detract from the import of the mechanism which prevails during an infection. In a previous paper[1] the writer has stated his case for specificity with regard to plague. So far as plague bacteria are concerned, I believe that these act as a matrix for the anaphylatoxic substance and that a proteotoxin obtained with the B. pestis is an example of specific poison production. If such a poison *is* specific, then a resistance, when developed against it, ought logically to be of value in warding off the particular organism which was utilized in its manufacture. Zinsser[2] has made the first strides in the direction of demonstrating actual resistance to bacterial proteotoxins and it seemed to the writer that no method could be more desired for studies in plague immunity than one which took into account active bodily processes approximating the supposed mechanism of bacterial infection. This appeared to be an ideal method of approach because the evidence at hand indicates that the mechanism of infectious diseases is logically referable to some sort of process by which toxic substances are liberated in the effort of the normal body to combat the invasive element, be it typhoid or plague. The introduction of bacteria will give rise in the infected body, to a response such that immune substances may be assumed to circulate in the blood. These substances may or may not hold the balance of power, to the end that the animal may survive the infection or succumb to it, depending upon the relationship existing between the quantity of immune-body (sensitizer), the rate of multiplication of bacteria and the normal serum components. Any deviation from the usual proteotoxic phenomena ought to be considered as an inherent difference existing for the particular species of bacteria used. The plague organism, from the very outset, has revealed definite differences[3] apart from the fact that the usual methods of immunization have failed in the case of B. pestis. This in itself seemed sufficient to warrant something unique with respect to the organism and a method yet untried appeared to be worth consideration.

It has been highly desirable to find some means whereby the animal body may build up an *active resistance* to a possible infection, and in order that this may take place it is necessary for the body to take an *active part* in the process. This has not been

realized in plague infections owing to the fact that B. pestis is so virulent that it overwhelms the natural body defenses. In "proteotoxin" parlance, this would say that the sensitizer produced in response to an invasion with this bacterium, so combines with the organism that the normal serum component, complement, liberates a powerful poison by acting upon the preformed complex. What we have then in this method which is about to be described, is essentially a procedure which simulates the course of the disease itself—the plague organisms playing an active *role* in the production of a poison which will immunize against the matrix itself. Obviously, the more toxic the poison, the better the chances of obtaining immunity provided the animal may be made to survive doses of the poison. In this manner we approximate the ideal—living virulent bacteria as immunizing agents—which in the case of plague is of course out of the question.

Whether or not the *specificity* of proteotoxins is an established fact, if only for the plague organism, is not within the province of this paper to discuss. It is merely the writer's contention that shock—producing substances, in all respects conforming to what we understand as "proteotoxins," seem to give rise to a definite resistance and immunity to the particular organism used in the experiments. Efforts have been made in this work, so far as possible—because of the unfavorable conditions under which it has been necessary to pursue these investigations--to control the results which are striking from the theoretical standpoint itself. The main idea, however, was to find a method which would give promise of immunity. From the experiments outlined below, the theory with regard to plague proteotoxin specificity seems to be supported by the findings that B. pestis *per se* did not play a part in inducing resistance, for "control" animals which receive considerable doses of material comparable to the supernatant fluid used for "treated" animals, failed to survive doses of plague bacteria which killed normal animals yet failed to affect those which were treated with proteotoxin. Moreover, the experiments show that animals will survive inoculation with virulent plague even when proteotoxin is administered in such dosage that sensitized B. pestis, if present, cannot conceivably exercise any immunizing action owing to the fact that they are exceedingly few in number. Several tests made at different times on the centrifuged proteotoxin and on control salt solution, gave no growth when a few loopfuls of the material were streaked on agar. When

centrifugation was not thorough—one half hour at moderate speed, for example,—a few B. pestis colonies developed after culturing.

The close relationship of the phenomenon of antianaphylaxis and that of resistance to proteotoxins suggested the feasability of applying the facts concerning the former to a method involving apparently similar principles. In a very early work by Otto[4] on anaphylactic phenomena, he showed that repeated injections of considerable amounts of protein at definite short intervals resulted in a state of antianaphylaxis or immunity to later injections. It seemed reasonable, therefore, to assume that repeated injection of proteotoxin, if this contained specific substances of the plague organism—would give rise to an immunity toward plague itself.

The results presented here are offered hesitatingly, in view of the possible significance these findings may have, yet the writer feels that in spite of the limited number of experiments, the results seem to be encouraging. Until extensive data are procurable on the value of this method for humans, little can be vouchsafed as to its practicability Experiments are now being conducted along the following lines with the hope that the final product may be utilized in those countries where plague is sufficiently prevalent to enable us to amass convincing data as to the actual value of this active immunity:

Duration of active and passive immunity.

Intensive study on concentration of protective substance for both active and passive treatment.

Protective and curative value of serum against virulent B. pestis over varying intervals of time.

Potency of serum when inoculated simultaneously with B. pestis.

TECHNIC.

The materials used in the production of proteotoxins were B. pestis, antipest serum (sensitizer) obtained from rabbits which had been injected with plague bacteria, and normal horse serum. *B. pestis* was grown on plain extract agar slants, incubated at from 30 to 35 deg. C. for 24 hours. The slants were of approximately uniform size and experience with the inoculation of cultures made it possible to attain considerable accuracy sufficient for the purpose.

The proportion of culture, sensitizer and normal serum were carefully worked out and discussed in earlier publications[5], and in the following experiments the most favorable combination was utilized.

Sensitizer was obtained according to the following method. Healthy rabbits, ranging in weight between 1,200 and 1,600 grams, were injected with plague bacteria (grown on extract agar slants) emulsified in salt solution and heated for 30 minutes at 58 deg. C. At first, intravenous injections were made but it was found that intraperitoneal inoculation was attended with less danger of sudden death due to agglutination in the capillaries, and likewise was capable of producing a serum potent enough for the purpose, In addition, this method of injection seemed to be more easily borne by the animals. The amount of culture, given at weekly intervals, was gradually increased from 0.1 of a slant up to a whole slant, the dosage usually being 0.2, 0 4, 0.6 of a slant for the second, third and fourth inoculations. At times this treatment was modified according to the reaction of the animal so that a whole slant was injected one week after the third dose of 0.4 or 0.5 of a culture. On an average the "sensitizer" rabbits received but four doses rather than five. The criterion was always the potency of the serum so obtained and was measured macroscopically for its agglutinating power. This seemed rather remarkable in its striking rapidity, for when the salt solution suspension (as will be subsequently described) received the volume of heated sensitizer in a centrifuge tube, an almost immediate flocculation ensued and within a few minutes the bacteria could be made out in minute clumps suspended in a clear fluid. Within thirty minutes at body temperature, the organisms always settled to the bottom of the tube, leaving a clear supernatant fluid.

Horse serum was obtained with sterile precautions from the jugular vein of a normal Army horse kindly loaned by the U. S. Army Veterinarian. The blood was collected in a tall jar and allowed to stand in a cold room for periods ranging from 18 to 36 hours. After this time the clear serum was pipetted off and placed in amber-colored glass stoppered bottles. During the warmer season phenol was added as a preservative in the concentration of 0.3% but usually nothing was added to the serum which was unheated. In the preparation of proteotoxin no serum was used which exceeded eight weeks in age.

Proteotoxin.

Agar slants of B. pestis were washed off with 0.25 c.c. NaCl solution and sensitizer, heated at 56 deg. for 30 minutes, was added to the emulsion in the proportion of 1.5 to 2.0 c.c. for each 1.5 slants. After one hour's incubation at 37 deg. C., the material was centrifugated for 10 to 15 minutes, the supernatant fluid pipetted off and the bacterial sediment washed once with salt solution. Normal horse serum was then added to the sensitized complex in amounts of 10 c.c. for each 1.5 slants of B. pestis used. The final mixture was placed in large centrifuge tubes, and incubated for 14 hours at 35 to 37 deg. C. At the end of this time, the material was centrifugated for one hour at moderate speed. The supernatant fluid when pipetted off was clear and gave no turbidity on agitation. Tests for the presence of B. pestis were invariably negative when the centrifugation was carried out for this length of time. Prior to injection, the clear fluid was heated at 56 deg. C. for 30 minutes.

The above procedure used in the production of the toxic substance was adopted as a standard but it was impossible to adhere rigidly to the outline, particularly in regard to the temperature of incubation during the long period when normal horse serum acted upon the sensitized organisms. The intensely cold weather disarranged the incubator so that at times 27 deg. C. was the maximum temperature recorded during the entire period of incubation. Experiments which have been described elsewhere[5] show that the temperature range is quite flexible for obtaining potent proteotoxins, so that the final product is hardly affected by variations within certain limits. Deviations with respect to the sensitizer used have been mentioned above.

Method of Injection.

Except where otherwise indicated in the protocols, the intraperitoneal method of injection was used. The absorption by this route seemed to be slower and, in the amounts given, devoid of shock which was usually so severe in the case of intravenously injected (marginal vein) animals that death supervened within a few minutes. Very often, the rabbits thus treated died within a day or two, or at the most, after a week, with severe emaciation and slow poisoning. Intraperitoneally administered, the proteotoxin caused no visible disturbance in the animal other than a slight uneasiness at first. Ten to eleven days after the last injection with proteotoxin, virulent B. pestis was administered.

EXPERIMENT 1.

To determine the value of repeated doses of plague proteotoxin in establishing a resistance to living virulent B. pestis intraperitoneally injected.

In this experiment the amount of sensitizer used was 2.0 c.c. for each three slants of B. pestis and the normal horse serum added was 25 c.c. for the complex. Preliminary tests showed that the proteotoxin was weak and could be tolerated in fairly large amounts when injected directly into the circulation *via* the marginal vein. The temperature of incubation during one hour of sensitization was 34 deg. C. and that during proteotoxin formation was 30 to 34 deg. C.

Rabbit No.	Weight	Dose	Route	Dose B. p.	Result
1	1085 gms.	6.0 c.c.	Intraven.	1/200	Well; Lived.
	1052	3.0	Intrap.	slant, 11	
	950	2.0	,,	days after	
	990	3.0	,,	last injec-	
	1025	.....	,,	tion of proteotoxin	
2	1080	5.4	Intraven.	,,	Well; Lived.
	910	3.0	Intrap.		
	870	.....	,,		
			Controls.		
3	1000	.....	Intrap.	1/200 slant	Died after 72 hours with acute septicemic plague. All organs and blood showed enormous numbers of B. p.
4	1200	.....	,,	,,	Died after 50 hours. Post mortem ditto 3.

In this experiment it is interesting to note that one animal received considerably more proteotoxin than the second, yet protection was just as marked in the latter. Rabbit 2 showed a very poor reaction to the first injection and continued loss in weight at each weekly examination made it imperative to discontinue treatment until more than three weeks later when the second injection was given. The fact that this animal evidenced a striking tolerance to the inoculation with plague, suggested experiments with fewer doses of proteotoxin administered after longer intervals. (see Experiment 5.)

Rabbit 1 was killed ten days after the test dose of plague was given, and at autopsy the animal showed no lesions. The liver revealed a few minute fatty areas. Blood smears were marked by a great number of polymorphonuclear leucocytes. This point will

be discussed later in connection with the probable mechanism of protection observed in treated rabbits.

EXPERIMENT 2.

The object of this experiment was to study the tolerance exhibited for considerably larger doses of virulent plague bacteria. Proteotoxin was prepared as in the preceding experiment and injections made at weekly intervals, with the dose of plague administered 11 days after the last injection.

Rabbit No.	Dose	Weight	Route	Dose B. p.	Result
5	7.2 c.c.	1090 gms.	Intrav.	1/100	Well: Lived.
	4.0	1150	Intrap.	slant	
	3.0	1050	,,		
	5.0	1150	,,		
	.....	1175	,,		
6	2.8	1015	Intrav.	,,	Died after 4 days and 6 hours. Post mortem gave none of the typical signs of plague at the site of inoculation, the subcutaneous tissues or in the organs. Slight congestion of the inguinal vessels was present. Spleen smears showed numerous B. p.; blood smears were neg. The peritoneum contained a large amt of exudate.
	4.0	945	Intrap.		
	3.0	860	,,		
	3.0	995	,,		
	.....	1015	,,		
			Controls.		
7	.....	1420	Intrap.	1/100 slant	Death after 80 hours. Acute plague in organs and blood
8	.....	1195	,,	,,	Death after 44 hours. Typical plague infection.

Marked protection is evidenced here, as in the preceding protocol. That the amount of material injected may have a bearing on the result is suggestive, when the two animals are compared. Rabbit 6 lived about one day longer than the heaviest of the control animals, of which the weight exceeded that of the test rabbit by 400 grams. The findings at post-mortem indicated some degree of protection. Rabbit 5 was killed nine days after it had received the plague inoculation. No lesions were demonstrable and blood smears were characterized by enormous numbers of polymorphonuclears.

EXPERIMENT 3.

The procedure was the same as in Experiment 2, with the exception that the incubation temperature during the 14 hour

is given below, serves, therefore, merely as an additional experiment similar to those which precede.

EXPERIMENT 4.

Rabbit No.	Weight	Dose	Route	Dose B. P.	Result
13	610 gms.	(x) 2.8 c. c.	Intrav.	1/400 slant	Well ; Lived.
	557	3.0	Intrap.	ten days	
	548	3.0	,,	after last	
	620	3.8	,,	injection.	
	725	.....	,,		
14	595	(x) 2.6	Intrav.	Same as No.	Well ; Lived.
	695	3.2	Intrap.	13.	
	695	3.0	,,		
	715	4.0	,,		
	765	.....	,,		
15	620	3.0	Intrap.	1/200 slant	Death, 48 hours.
	580	1.8	,,	ten days	
	595	2.5 c.c.	,,	after last	Acute plague.
	630	3.5	,,	injection	
	700	.....	,,		
16	695	3.2 c. c.	Intrap.	1/100 slant	Death. acute plague
	700	3.5	,,	ten days	after 44 hours.
	765	4.0	,,	after last	
	740	4.0	,,		Death, acute plague
	795	.....	,,		after 60 hours.

Controls.

Rabbit No.	Weight	Dose	Route	Dose B. P.	Result
17	945 gms.	.....	Intrap.	1/200 slant	Death, acute plague after 80 hours.
18	940	.....	,,	1/400 slant	

Rabbits 15 and 16 became ill within 24 hours after receiving the test dose of plague. Autopsy revealed a very severe infection. With regard to a culture of virulent B. pestis, it is impossible to draw a sharp line of demarcation between a "minimal lethal dose" and one which, if resisted, would tend to illustrate the point desired. Considerable doses of culture were purposely given in this series of small animals in order to test the resistance toward an *exaggerated* infection. The animals will naturally differ in their individual susceptibilities to inoculation, but it may be said that for plague, the natural mode of infection requires but a very slight amount of inoculable material which need not be introduced directly into the system as has been done in all of these experiments. Detailed studies dealing with the relation between the total amount of proteotoxin given and the resistance to varying doses of B. pestis would make this point clear.

Earlier in this paper a note was made of the fact that two injections of proteotoxin, spaced after a considerable interval,

(x) Proteotoxin passed through Reichel filter.

period ranged from 31 to 33 deg. C. and an additional injection was made on one animal (No. 9).

Rabbit No.	Weight	Dose	Route	Dose B. p.	Result
9	1065 gms.	2.0 c.c.	Intrav.	1/100	Well; Lived.
	1115	4.0	Intrap.	slant, 10	
	1075	3.0	,,	days after	
	1025	3.0	,,	last in-	
	1105	4.0	,,	jection.	
	1175	.....	,,		
10	1165	4.8 (x)	Intrav.	3/200	Death. 5 days and 9
	1125	3.0	Intrap.	slant, 10	hours. There were
	1010	2.0	,,	days after	apparent signs of
	1157	4.0	,,	last in-	chronic plague in
	1175	.....	,,	jection.	liver and spleen.

Controls.

Two rabbits weighing respectively 1,200 and 1,190 grams, were given 1/100 slant intraperitoneally. These animals died within three days of acute septicemic plague.

Here we see again a definite resistance on the part of treated animals. Even 3/200 of a slant which is far in excess of a "minimal lethal dose" failed to kill Rabbit 10 within the usual time limit which for this dose would be less than 40 hours. This animal appeared perfectly healthy until the fourth day after inoculation when it became apathetic and refused food. Rabbit 9 was etherized seven weeks after receiving the dose of B. pestis. No changes were noted in the organs. The serum was used as sensitizer in other experiments.

It seemed of interest to study the action of filtered proteotoxins in an effort to correlate shock-production with the development of tolerance to living bacteria. Some writers have found that filtration of proteotoxin inhibits shock and in the course of this study an experiment was planned with the hope that a series of injections with filtered material would reveal an interesting relationship. The findings of Zinsser[6], with regard to the peculiar behavior of filtered proteotoxins were confirmed. A series of animals which were injected intravenously with considerable quantities of the material showed no shock, whereas controls which were treated with unfiltered material reacted severely in typical fashion. Unfortunately, it was possible to make but one injection with such filtered proteotoxin—the first dose—on account of the severe cold which set in and froze the laboratory water supply necessary for the filtering apparatus. The protocol which

(x) Severe shock followed the injection of proteotoxin

seemed to protect a rabbit so treated. In order to study the value of such a procedure, a series of animals were given two injections of the material, allowing two weeks to elapse between the doses. Proteotoxin was prepared in the following manner: Three slants of B. pestis were washed off which 0.75 c.c. NaCl solution and 4.0 c.c. of sensitizer added. After incubating for one hour at 37.5 deg. C., the mixture was centrifugated and the sediment recovered and washed once with salt solution. Twenty cubic centimeters of normal horse serum were added to the complex and the whole incubated at 37.5 deg. C. for 14 hours. One hour's centrifugation rendered the supernatant fluid entirely clear. This was heated for 35 minutes at 56.5 deg. C. and injected intraperitoneally.

EXPERIMENT 5.

Rabbit No.	Weight	Dose	Amount B. pestis	Result
19	955 gms.	3.0 c.c.	1/400 slant ten days	Well, Lived.
	1012	4 0	after last injection.	
	1000	.....	(intraperitioneally)	
20	950	3.0	,,	,,
	980	3.0		
	995	.....	,,	
21	820	3.0		,,
	715	3.0		
	815	.....		
Controls.				
22	975	.....	1/400 slant	Death, 5 days Acute
23	910	.....	intraperitoneally.	plague. Death, 6 days, Acute plague.
24	1015	.....	,,	,,

The above results indicate that a definite response is elicited in the animal body by so few as two injections spaced two weeks part. This long interval is of distinct advantage in enabling the animal to stand up under the strain of treatment which normally occurs. One of the primary objects of this experiment was to attempt to throw some light on the question of what influence a few heated sensitized B. pestis may have in bringing about the resistance noted. A small total volume of material was given so that in the amount of proteotoxin injected, the few organisms which might be present, would hardly have a significant effect. In order to double—control this point which appears to be of theoretical interest, at least, the following experiment was performed.

EXPERIMENT 6.

Six slants of B. pestis were sensitized for one hour at 37.5 deg. C. with 8.0 c.c. of sensitizer, centrifugated to remove the organisms, and the sediment washed once with normal saline. To

the organisms were then added 40 c.c. of normal salt solution and the suspension finally incubated at body temperature for 14 hours. After an hour's centrifugation, the supernatant fluid was pipetted off and heated at 56.5 deg. C. for 30 minutes. Injections were made into the peritoneum at weekly intervals, as in the proteotoxin experiments, and living virulent plague injected *via* the same route ten days after the last dose of test substance. The salt solution which was used for this experiment appeared fairly clear after prolonged centrifugation, and in one instance, as designated below, was distinctly turbid with B. pestis.

Rabbit No.	Weight	Dose	Dose B. pestis	Result
25	1360 gms.	6.0 c.c.		
	1260	(x) 4.0		
	1190	3.4		
	1182	4.0		
	1230	.....	1/200 slant	Death, acute plague, 48 hours.
26	720	4.0		
	650	(x) 4.0		
	575	3.0 c.c.		Death, acute plague, 46 hours.
	610	6.0		
	710	.....	1/400 slant	
	930 gms.	4.0 c.c.		
	845	(x) 4.0		
	865	5.0		
	862	5.0		
27	795	.....	1/400 slant	Death, 40 hours, Acute plague.

Although few animals were used in this experiment, the results seem to be well marked, since the amount of material injected is considerably greater than that used in any of the other experiments here outlined. In addition, we have the fact, although a more accident, that the second injection was made with material which might by itself be expected to possess some immunizing action inasmuch as it contained enormous numbers of plague bacteria which were not removable by centrifugation.

In this study no attempt has been made to determine the duration of active immunity, except in a preliminary way. A series of animals which were given several injections of the material, were to be tested with doses of living virulent plague at intervals of one, two, three, four, five and six months after treatment. Owing to discouraging mortality among the animals, as a result of natural weakness due to close interbreeding, the completeness of the experiment was interfered with and it is possible to report the results for those animals only which received the test dose of plague bacteria one month after the last injection of proteotoxin.

(x) Centifuge defective, supernatant fluid was heavily clouded with B. pestis.

Experiment 7.

The rabbits in this series received four intraperitoneal injections of proteotoxin obtained with B. pestis. The techic followep was the same as that recorded in preceding experiments. The test dose of plague was administered *via* the peritoneum *thirty days* after the final injection.

Rabbit No.	Weight	Dose	Dose B. pestis	Result
28	610 gms.	2.0 c. c.		
	645	3.0		
	680	4.0		
	715	4.5		
	605	.....	1/400 slant	Well ; Lived.
29	650	2.0		
	715	4.0		
	725	4.5		
	765	5.0		
	750	.....	1/400 slant	Well ; Lived.
30	625	2.5		
	640	3.0		
	635	3.0		
	650	4.0		
	710	.....	1/400 slant	Well ; Lived.
		Controls.		
31	810	.....	1/400 slant	Death after 4 days Acute plague.
32	790	.....	1/400 slant	Died after 4½ days. Acute plague.

The results of this experiment show that rabbits treated with plague proteotoxin are definitely resistant to inoculation with B. pestis at least one month after treatment. Two untreated animals (31 and 32) became ill on the second day following injection with B. pestis and died of typical plague in about four days. The three treated rabbits showed no illness whatever and remained alive. One of these was etherized ten days after receiving the test dose of organisms and at post-mortem showed no lesions. The blood contained very many polymorphonuclears.

An interesting question arises as to the mechanism of this resistance to infection with living organisms used in the preparation of the proteotoxins, also, as to the localization of this apparently specific tolerance. From the scanty material available in the course of these experiments, it seems as if some support might be given to the hypothesis of a powerful leucocytic response to the substance injected. When animals were treated intraperitoneally, an injection of the test dose of plague bacteria was invariably followed by marked accumulation of polymorphonuclears in the peritoneal exudate, as well as in the blood. This was not observed

in untreated rabbits. Whether or not the substance gives rise to a bacteriolytic action has not yet been determined. The question of localization of tolerance may be passed over with a few words. From the nature of plague infection it is evident that an sbsolute immunity toward inoculation by any particular route would depend upon the state of resistance developed by the treatment. Results of tests made on these points may, therefore, fail to answer the question. There is no way of controlling the efficacy of the treatment other than by the use of a very large series of animals for each type of inoculation practised, and by further making cross injections with plague organisms, in order to determine the value of intraperitoneal injections of proteotoxin for intravenously inoculated B. pestis and that of intravenous treatment for organisms administered by a different route. The few experiments which were made on this point indicate that the animal does not tolerate any considerable dose of plague when the bacteria are given intravenously after treatment with proteotoxin. Of course, since it was not possible to determine with sufficient controls whether or not the material was efficacious, it is difficult to venture an opinion. A typical experiment is given below.

Experiment 8.

Rabbit No.	Weight	Dose	Route	Dose B. p.	Result
33	1115 gms.	1.0 c. c.	Intrav.		
	1045	3.5	,,		
	980	3.0	,,		
	930	2.5	,,		
	965	.....	,,	1/400 slant, 11 days after last injection.	Death, 5 days.
34	1335	3.2	,,		
	1385	4.0	,,		
	1275	4.0	,,		
	1444	5.0	,,		
	1320	.....	,,	1/400 slant, 11 days after last injection.	Well, lived
35	1200	2.8	Intrap.		
	1197	3.8	,,		
	1286	4.5	,,		
	1026	.....	Intrav.	1/800 slant, 10 days after last injection.	Well, lived
36	1025	3.0	Intrap.		
	1098	3.6	,,		
	1172	5.0	,,		
	1984	.....	,,	1/400 slant, 10 days after last injection.	Death, 3 days Blood negative; Very few organisms in spleen.

Controls.

Rabbit No.	Weight	Dose	Route	Dose B. p.	Result
37	1408 gms.	.....	Intrav.	1/800 slant	Death, three days, acute septicemic plague.
38	1765	.....	Intrap.	1/400 slant	Death, acute plague.

39 This rabbit was treated with salt solution prepared as in Experiment 6, as an added control. The animal received, in all, 16 c.c. of material in four intravenous injections, and the test dose of B. pestis was given ten days after the last injection, into the marginal vein of the ear. At each weekly injection the animal weighed respectively 1325, 1340, 1270, 1165 grams and 1151 grams at the time it received the plague inoculation. 1:800 slant B. pestis killed the rabbit in four days.

SUMMARY AND CONCLUSIONS.

The treatment of rabbits with proteotoxins obtained with B. pestis confers a definite resistance on the part of the animal to systemically introduced plague organisms.

The apparent immunity protects in at least 75% of the animals treated, taking the *entire* number of cases into consideration. Below a certain dose of bacteria, the protection conferred is much greater.

Combined intravenous and intraperitoneal injections of the proteotoxin seem to be more effective than either method by itself, although intraperitoneal treatment of rabbits results in a powerful resistance to plague bacteria administered by that route.

The immunity, insofar as it has been possible to determine in these experiments, is definitely marked for at least one month after treatment.

Injections given at intervals of two to three weeks give rise to a definite resistance to inoculation with living, virulent plague.

B. pestis appears to be the matrix for a specific poisonous substance analogous to proteotoxin, if not identical with it, and capable of inducing in the animal body a specific resistance to the organism which is used in the manufacture of the toxic element.

Observations made up to the present time support the hypothesis that one of the most potent factors in the protective mechanism is that of leucocytosis.

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PLAGUE.

(*Reprinted from the Encyclopoedia Sinica*)

Plague has been known in China under different names, such as, *wen-i* (瘟 疫), *i-cheng* (疫 症), *pai-ssu-tu* (*i.e.* peste 百 斯 篤) and *shu-i* (鼠 疫). The last, meaning rat plague, is perhaps the most scientific and accurate, and is now adopted in all medical and lay books published in Chinese.

History.—The[1] history of plague is perhaps more fascinating than that of any other known disease, but it is not proposed to enter into details here except in so far as it concerns China.

Plague is a very old disease and is mentioned in the Bible as occurring centuries before the Christian era in the land of the Philistines. Chinese history also teems with references to *i-cheng*, but it is not quite certain how many of these reported epidemics are due to typhus, famine or bubonic plague. The first authentic pandemic of plague originated somewhere in Egypt (B.C. 542) and spread to Constantinople and neighbouring cities. The second one recorded began insidiously in the 11th century and developed into the great pandemic known as "Black Death," because the sick turned black before death. Much dispute has arisen as to the origin of this great epidemic. The Russian records place it in India, the Grecian in Scythia, the English in India, the Arabians in Tartary and the Italians in Cathay (China). It is probable that marmots inhabiting that long chain of mountains bordering on India and Thibet were the precursors of this disease and by infecting the household rat and then man succeeded in spreading the plague, which, though at first bubonic in character, became pneumonic later on. This pandemic spread all over Europe and most parts of China and killed millions of people. The Great Plague of London swept over England in the sixteenth century, and has been vividly described by Daniel Defoe in his great book. In India plague has appeared off and on since the 11th century, but it was not until the great outbreak of 1896 that serious attention was drawn to it in that country. Prof. W. J. Simpson (London) maintains that the extraordinary epidemic, which swept

over Canton and Hongkong in 1894 and two years afterwards spread all over India, had its origin in the province of Yunnan where a Catholic priest encountered it in 1871 under the name of *yang-tzu* (痒 子). It is quite possible that this too, as in the case of the Black Death, may be traced to the marmots of the Himalayan and Altai Mountains. This view is supported by the work of American investigators, who have found plague in an endemic form among the ground squirrels inhabiting the Rocky Mountains. The last epidemic occurred in Manchuria and North China in the winter of 1910-11, known as the Pneumonic Plague, which in a few months killed over 60,000 people. This outbreak was traced to some bubonic cases in the Astrakhan district (Russia) where it had been endemic for scores of years.

Geographical Distribution.—Plague is an insidious disease begining slowly and then, if not suppressed in time, developing with unusual virulence. The outbreak in 1894 at Hongkong has maintained its course unto the present time, and has invaded India, South China, Cochin China, Japan, Formosa, Australia, the Philippine Islands, South America, West Indies, United States, Cape Clony, Madagascar, Egypt, Asia Minor, Persia, Mauritius, Straits Settlements, Russia, West Africa, Siberia, Marseilles, Hamburg, and even England. The total number of deaths due to it approximate ten millions, of which six millions have occurred in India. With increase of knowledge of its cause and prevention, however, there is every sign of its dying out. Taking the two cities of Bombay and Hongkong, hotbeds of plague some years ago, we find that in 1915, only 599 cases were reported in the former city and 144 in the latter.

Causes.—The actual organism of plague is a small, non-motile, straight bacillus discovered by Kitasato in 1894. It grows and stains in a characteristic manner, is easily killed by heat but can withstand very great cold. Besides man and the rat, it may attack all sorts of rodents as well as dogs and even cats. Once it enters the human body it rapidly multiplies in number, and if death occurs the bacillus may be found in almost every organ of the body. The usual form met with is the bubonic variety, caused by the rat flea. Thanks to the excellent work of the Indian Plague Commission and painstaking researches carried out in different parts of the world during the last twenty years, our knowledge of the plague has immensely increased. The following is a summary:—

1.—Both the black rat (mus rattus) and the brown rat (mus decumanus) are the principal agents by which bubonic plague is carried from place to place. Just before an epidemic occurs, these rats may be seen dying in greal numbers, and migration and increased mortality of these animals are ominous signs of coming plague in a community.

2.—The rat infects man through the rat flea (usually *xenopsylla cheopis*, but sometimes *ceratophyllus fasciatus*, which appears to convey the germ in a mechanical manner.

3.—There is no fear of man infecting man in the bubonic type. In pneumonic plague, on the other hand, the greatest danger is experienced, owing to direct infection through the respiratory passages.

4.—It is quite possible that fleas and other insects attached to the baggage and clothing of infected persons may contribute to the spread of the disease, but a more potent factor is the migration of infected rats, carrying with them innumerable fleas.

5.—Insanitary conditions have little or no relation to the occurrence of plague, except in so far as they favour infestation by rats. In pneumonic plague, insanitary habits, such as spitting and overcrowding, tend to spread infection.

6.—Bubonic plague is more prevalent in warm weather, whereas the pneumonic type is most dangerous in winter.

Types of plague.—Three types of plague may be distinguished:—

BUBONIC, PNEUMONIC AND SEPTICEMIC.

a.—The Bubonic variety may be seen in a mild or severe form. In the former case (*pe tis minor*) the patient suffers for a few days from fever with swelling of the glands and perhaps suppuration, and there is no danger. Such cases often occur at the beginning of an outbreak. The severe bubonic variety constitutes 80 per cent of all cases. The stage of invasion is characterised by headache, backache, stiffness of limbs, a feeling of anxiety and restlessness, and depression of spirits. The fever gradually rises until the fourth day, when it drops a few degrees and then rises again. The tongue turns brown, the patient feels very ill and may die. Swelling of the glands (buboes) is usually

present in the groin, sometimes in the arm-pit, sometimes in the neck. Bacilli can always be detected in the fluid obtained by puncturing the buboes. Suppuration of the buboes is a good sign. Red spots (haemorrhages) frequently appear on the skin, and when extensive are bad omens. Nearly ten per cent of untreated cases of bubonic plague recover in an epidemic, but if serum is used, 20-25 per cent may be saved.

b.—Pneumonic or Pulmonary Plague was considered a rare type until the Manchurian outbreak of 1910-11. It begins with sudden fever, shortness of breath, headache, bone ache, cough and discomfort in the chest region, after an incubation period of 2-3 days. Very soon the fever increases, the pulse becomes fast and small, marked signs of lung involvement are observed, and a pink, liquid, frothy sputum is coughed up containing enormous numbers of plague bacilli. Owing to difficulty of breathing, the patient becomes blue in the face, signs of bleeding in the mucous membranes appear, and the patient dies in 2-4 days after appearance of symptoms. No authentic case of recovery has been recorded. It is perhaps the most virulent type of all known diseases.

c.—The Septicemic type may be the result of bubonic or pneumonic infection. Haemorrhages are common, and the bacilli are always present in the blood.

How to Detect Plague.—This must be left to the trained doctor, and requires the maintenance of a laboratory where the appliances for the detection of plague and other infectious diseases are at hand. Plague itself is easily diagnosed, as the organism causing it has peculiar features. Unless proper measures are adopted, the first few cases may be overlooked, leading to disastrous results. In all suspicious cases, the medical man examines under the microscope either the bloody contents of a bubo or the phlegm coughed up by the patient. Once diagnosed the necessary notification and preventive measures will be undertaken by the medical attendant.

PLAGUE PREVENTION.

The prevention of Plague is based upon common-sense laws for the prevention of most infectious diseases, such as, the establishment of isolation hospitals, laboratories, trained sanitary staffs, and education of the general public in matters of hygiene. Into this general scheme I will not enter, but confine myself to some less known data. On the principle that bubonic plague is primarily a rat disease, any measures taken should be directed towards the extermination of these pest and their allies the fleas. For this purpose, all new buildings should be made rat-proof so as not to allow any loophole for rats to breed; infected old buildings should either be rebuilt or have their floors and ceilings made rat-proof; godowns in particular should be rearranged so as to house as few rats as possible. In this work rat traps and poisons (preferably made with phosphorus) may be freely used. There is no need to curtail seriously the freedom of human beings, for apart from rats these are negligible in the dissemination of bubonic plague. Hitherto most authorities have laid too much stress upon the human and too little upon the rat factor as a means of combating plague. All facts point to the need of dealing with the rat population in an infected district rather than interfering with the free movement of the travelling public. The extension of infection into clean territory may be prevented by supervision of outbound shipping, destruction of rats in ships by fumigation, rat-proofing of railway-cars, inspection of cargo, etc. To these precautions additional safety may be secured by restrictions regarding loading and the use of rat-guards, etc. A simple workable method of plague prevention, which has been adopted by the Shanghai Health Department under Dr. Stanley may be mentioned here :—

Public Measures.

1.—Survey of plague deaths among man and rat.
2.—Careful storage of refuse in rat-proof receptacles, and daily removals.
3.—Rat-proofing of houses, temporary and permanent.
4.—Rat destruction by trapping and poison, beginning at the periphery and working towards the centre.

5.—Preventive inoculation, beginning with the sanitary staff.

Individual Measures.—Motto:—No rats, no plague!

A house that is rat-proof is plague-proof!

1.—Rid your house of rats by trapping and poisoning.
2.—Make your house as rat-proof as possible.
3.—Provide no food for rats, keep everything clean, and store everything in properly covered iron receptacles.
4.—Use solid floors wherever possible.
5.—Inspect regularly openings for drains, furniture, etc.
6.—Burn all trapped or poisoned rats. Send those found dead to the Health Office, using tongs for handling.
7.—Get vaccinated if exposed to infection.
8.—In case of difficulty communicate with the Health Officer.

Prevention of Pneumonic Plague entails a different method of procedure. Here the routine examination of rats is unnecessary unless cases of plague have occurred among them before. Being essentially a man-to-man infection, pneumonic plague must be strictly controlled from the beginning. Patients suspected of the disease must be at once removed to the isolation hospital and the diagnosis made from the sputum. Those who have been living with the sick must be taken to the quarantine station, and examined frequently every day. As soon as definite signs of plague appear in any one, he must be segregated in a similar way. All members of the hospital and sanitary staff must wear properly fitting gauze masks. These masks are easily made from a piece of gauze 2½ feet long covering a layer of cotton wool (4 inches square) and divided into three slips at either end for tying over the head and neck. This mask is the best protection against infection Disinfection of the infected quarters should be undertaken as ordered by the authorities.

Preventive inoculation is usually done with Haffkine's vaccine, and has been proved successful in bubonic cases. During the pneumonic epidemic no vaccine of any sort proved effective. Serum treatment has saved 20-25 per cent of cases in India. No other medicine is of any avail in Plague.

N.B. Recent investigations, conducted by the Research Department of the Manchurian Plague Prevention Service, show that promising results of inoculation against plague may he expected from the proteotoxin method. See other articles.

WU LIEN-TEH.

A HYGIENIC CHINESE DINING TABLE.

With plate.

Most visitors to China, who have had the opportunity of tasting Chinese food, are in accord in hailing the Chinese as past masters in the art of cooking. Every American city of respectable size has its *chop suey* restaurant, largely patronised by American ladies, and in crowded centres like Chicago, New York and San Francisco, the Chinese restaurants are among the most prominent sights, being brightly lighted, serving expensive meals and employing orchestras and professional singers to whet the appetites of their patrons and patronesses. In London, Liverpool and Manchester there are now excellent Chinese restaurants, originally established for home-sick students but now visited by fashionable English people. Both in Paris and Berlin the same process of initiation is taking place.

Considering how much better the food at such places as Peking, Canton and Shanghai is, it may cause surprise why so few European and American residents in China have tasted the delicate dishes prepared in this flowery land. The main reason for this lies, I believe, in the uncongenial way in which the average Chinese table is laid, especially in public restaurants. In Peking, until a few years ago, the best eating houses took pride in the old and unswept kitchen through which all would-be patrons had to pass, and in the greasy black wooden tables upon which the food was laid. Great improvements have, however, been made in all large cities since the Revolution, and white clean table-cloths are now insisted upon in all modern homes and fashionable dining halls. In Shanghai and Canton this welcome change is particularly marked, and up-to-date three storied buildings, brilliantly lighted, could be seen where foreign ladies could be actually entertained with every comfort.

The method of eating, *i.e.* conveying food from the dish to the mouth, however, leaves much to be desired from a hygienic standpoint. In an ordinary Chinese meal three things are absolutely necessary, namely, a pair of chopsticks, a spoon and a bowl for rice. The spoon is plunged into the common bowl of

soup, every one helping himself and often making considerable noise. The chopsticks are used for picking up solid food from dishes placed on the table, thrust deepin to the mouth and then withdrawn. This process is repeated indefinitely. Among members of the same family this method may not be harmful, but one often has to sit among total strangers, who may be suffering from syphilis of the mouth, foul teeth, tuberculosis, pyorrhoea, ulcers and other diseases of the mouth. Under these circumstances, an American or Englishman who has been brought up in a strictly hygienic way at home may be excused for fighting shy of a Chinese dinner, however nice it may taste.

The overcome this difficulty, I have for some years adopted the *western* method of serving *Chinese* food. The pretty Chinese spoons, forks, chopsticks, bowls, dishes, wine cups and dessert trays are there, but each guest at table has his own set of things. The dishes are served separately to every one—usually in bowls resting on small dishes. After each course these bowls dishes and spoons are removed, and new dishes served. In this way, the most complete stranger feels at ease and certainly shows no aversion towards Chinese food. Another important consideration is the prevention of overfeeding to which so many are subject when choice foods are eaten in the old way. Four "small" dishes and six large dishes are usually sufficient in the new style instead of thirty as formerly.

At the last Conference of the Missionary Medical Association held in Shanghai (January 1915) I was asked by an American colleague to devise a hygienic method of eating Chinese food at home, as he was sure it would be better appreciated if it could be more attractively served. After some months' experience I feel now at liberty to recommend my hygienic dining tray to the notice of those who take an interest in such affairs (See photo.) This consists of a revolving stand, made as simple as possible either with wood or metal, which will hold a tray—either round or square-big enough to accomodate one large soup bowl and four dishes. The stand should be as low as possible and placed on the table so as to be within easy reach of those sitting around it. Each person at table has his own set of chopsticks, spoon, bowl for rice and small bowl for soup, and each dish on the revolving tray is fitted with a separate spoon. In this way every one of those sitting at table can help himself to the food without dipping his own spoon or chopsticks into the common bowl or dish and thus conveying

possible infection to others. By means of this simple contrivance Chinese food may be properly enjoyed in the most hygienic manner. Another advantage lies in the saving of one's silk sleeves from being dipped into the oily dishes, for any favourite entree may be revolved to a spot exactly facing the eater without his getting up.

I hope the above way will be universally adopted, and if possible improved upon. My first model cost only eighty cents. An improved form has ball-bearing attachments and may be procured from the Commercial Press, Ltd.

WU LIEN-TEH.

HORSE-FLIES AND ANTHRAX.

(*Reprinted from "The China Medical Journal," March, 1916.*)

During last summer two cases of cutaneous anthrax came under my notice. They were of interest because the question of direct inoculation by the bite of the horse-fly was involved.

The first case was a man named Lu, aged 52, a blacksmith, who lived about 70 *li* [里] from Harbin. On July 26th, 1915, he said he was stung by a horse-fly in the neck just under the chin Next morning he found he had a swelling one inch in diameter under the chin. On the top of this swelling there was an irregular scab, and round this there were vesicles containing clear fluid in which *B. Anthrax* was demonstrated. The swelling was excised *in toto*, the wound was partially sutured, and the patient made a good recovery. Though this man was a blacksmith he had never had anything to do with horses.

The other case came from Fuchinhsien, a place some hundreds of *li* down the Sungari River. A farm, financed by Chinese and American capital, is situated there with fifty horses and a number of workmen. This summer, 1915, seven horses died as the result of bites from horse-flies. In each case twenty-four hours after the bite, a swelling of the size of a man's fist appeared at the site and the horse died. Last year the flies bit several men, causing local swelling and pain, but with no fatal results. This year two men have been bitten and died. They were bitten on the face, and in twenty-four hours there appeared a local swelling; then the men appeared very ill, the cellular tissue of the neck became swollen, and they died in three days.

Of special interest is the case of the third man who was bitten above the right ear on July 18th, 1915. He was ill on the 19th, with swelling of the neck. He was brought by boat on the way to Harbin for treatment, but he died on the 21st before he arrived. On the 22nd the corpse was brought to the hospital for us to make a *post-mortem* examination, as those concerned were anxious to find out the cause of death. The workmen, too, were getting nervous.

Post-mortem Examination. The body was that of a big and strong-looking man. No observable mark was seen at the site

of the bite, *i.e.*, above the right ear. But there was much swelling, and petechiæ were seen on the right side of the face, the neck, and the chest.

Abdomen. Some clear serum was seen in the peritoneum. The spleen was enlarged, dark, and unusually soft. Microscopically, it was found afterwards to be hæmorrhagic and filled with *B. Anthrax.* The liver and kidneys appeared normal, though under the microscope there were hæmorrhages and bacilli.

Chest. Hæmorrhages were seen in the right pectoral muscles. Clear serum was found in the pleura. The heart and lungs appeared normal. There was some emphysema in the mediastinum. The blood found in the heart and the great vessels was tarry. Slide smears and inoculations on agar were made from the blood, and both showed the anthrax bacilli,

Neck. There was much œdema on the right side of the neck. A gland removed from the angle of the jaw on the right side was hæmorrhagic and microscopically full of bacilli. On the left side of the neck, glands were found to be enlarged but not hæmorrhagic. There was no œdema of the glottis.

The inoculations made on agar tubes showed typical growths of *B. Anthrax.* Microscopically, large spore-bearing gram-positive bacilli were seen. From a broth culture a loopful of broth was injected into a guinea pig subcutaneously by Dr. Wu Lien Teh. It died within thirty hours with all the signs of septicæmia. From the guinea pig *B. Anthrax* was again recovered. The inference is that horse-flies spread the disease among horses by directly transferring the bacilli from one animal to another by their bites. Conceivably, also, they bite living horses suffering from anthrax or feed on diseased carcasses, and then soon after bite man, thus carrying the bacilli from horse to man, and causing the malignant pustule. We had no opportunity of conducting experiments, however, to prove or disprove these points.

As prophylactic measures, we advised the people at the farm to bury all dead horses, to cover the living horses with nets to protect them from the flies, and to wash the horses daily with a weak solution of creolin. I have been told there has been no incidence of anthrax among the workmen since.

The horse-flies sent to us for identification from the farm measured about ¾ inch from head to tail, and were black in colour with large patches of yellow on the sides. As a tentative attempt

I classify them as follows: FAMILY, *Tabanidæ;* SUB-FAMILY, *Tabaninæ;* GENUS, *Hæmatopota.*

At the time the above observations were made, so far as I was aware, no experiments had been made proving that any of the Tabanidæ were agents in the propagation of anthrax or other human disease, though such agency was considered probable. Thus Alcock (*Entomology for Medical Officers*), states that the Tabanidæ, "though they attack man freely, do not, at any rate in most places, afflict them grievously as they do domestic animals, nor do they come much into dwelling houses, nor are they known to transmit the infection of any specific disease to man, though they have been known to transmit the surra trypanosome in India, and other pathogenic trypanosomes of domestic animals in Africa. The possibility of their infective agency in the case of man should, however, be always borne in mind."

Since writing the above, my notice has been drawn to notes published in the *American Journal of Tropical Diseases and Preventive Medicine* (Vol. 2, No. 4) where M. Bruin Mitzman is reported to have made successful experiments in the mechanical transmission of anthrax by means of *Stomoxys Calcitrans* and *Tabanus Striatus.* These species were made to feed on an infected guinea pig shortly before its death from anthrax and were then immediately transferred to healthy animals. By these means positive infection was produced. It was found that the greatest interval between the infective feed and the bite of the healthy host in which transmission was successful was 20 minutes. While such forced experiments do not necessarily prove that in the free state the disease is actually transmitted in this manner, yet the presumption that it is so transmitted is very strong. The cases here described should go far to place the matter beyond doubt.

J. W. H. CHUN.

N.B.—Some specimens of the Sungari horse-fly sent to Professor Marshall of the Bureau of Entomology, London, have been identified as *Tabanus amvenus* (*Walker*). W. L. T.

THE ANCIENT CHINESE ON POISONING*.

(*Reprinted from "The China Medical Journal," May, 1916.*)

The *Hsi Yuan Lu* (洗冤錄) has been for hundreds of years the standard treatise on forensic medicine for Chinese officials and native medical practitioners. One finds in it chapters dealing with modes of death, examination of the dead, signs of death, wounds, poisons, together with illustrations dealing with small but vital parts of the body, and some quite good pictures of various bones of the human skeleton. A study of this book makes one realize the causes of the comparatively slow progress of modern scientific medicine in China, for in the midst of a few excellent and accurate observations, based no doubt on actual experience, one finds the most absurd notions mentioned. In this article I propose to deal with the section on "Poisons and Their Treatment," adding occasionally a few remarks of my own.

According to the *Hsi Yuan Lu*, the symptoms of poisoning are differentiated according to whether the poison was taken on an empty stomach, after a full meal, or by old people. The general signs observed after death are stated to be:—pale face, small vesicles on the lips, contracted tongue (sometimes torn and fragile through previous struggle). black nails, congested throat, swollen abdomen, ecchymotic spots on the skin, and sometimes hæmorrhage from the nose, ears, and mouth.

As soon as a case of attempted poisoning is seen, the following measures are recommended.—

a. Puncture the temple or supra-orbital region with a magnetic needle.
b. Venesect at arm or shoulder, and let one pint of blood out.
c. Induce vomiting.
d. Examine the vomit, fæces, and urine if there be any.
e. Search for any drug or remaining poison on clothing.
f. Look for any instruments near body.
g. Note that some poisons do not enter by the mouth *e.g.*, bites by snakes or insects, therefore search for cracks or marks on the skin. In the case of bites by mad dogs, note the scar or wound on skin, which is black and swollen.

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* A paper read at the first Conference of the National Medical Association of China, held in Shanghai, February, 1916.

A curious method is suggested for differentiating poison taken *before* death, and that administered *after* death for purposes of deception, If poisoned before death, the whole body is congested, the organs decompose earlier, and the bones may be easily exposed. If poison be administered after death, no change in the skin, organs, or bones is observed.

Varieties of poison. Passing on to the varieties of poison, three classes are mentioned by the Chinese writers. (1) Animal poisons, *e.g.*, certain flies, insects, snakes, birds. (2) Chemical poisons, *e.g.*, croton oil, arsenic, mercury, alcohol, belladonna, bitter almond (hydrocyanic acid), aconite, silver nitrate, gold, calomel, opium, caustic potash, charcoal gas. (3) Vegetable and accidental poisons. I have not yet been able to identify fully the substances mentioned under this heading, but some of the statements border on the ludicrous. For instance, when turtle flesh is mixed up with a certain *chien* (蒹) grass, it is said to become very poisonous and able to produce innumerable small turtles. The urine of the horse is regarded as an antidote. I may here remark it is quite possible that by "accidental poisons" is meant ptomaines.

Chemical poisons. These form the most interesting group, and I will confine the rest of this article to them. It is noteworthy that alcohol was classed as a poison so long ago by the Chinese. and that the effects of opium, until lately the greatest curse in China, were also known. On the other hand, certain poisonous things which nowadays can be procured at Chinese shops or from apothecaries are not mentioned. Among these are: –aniseed, which Dr. Duncan Main informs me is used very frequently in Chekiang as a poison but is not fatal; white lead (a mixture of lead oxide and lead acetate), used largely in North China as a face powder; heads of matches (phosphorus), etc. The signs and symptoms mentioned in the *Hsi Yuan Lu* as being produced by these poisons, though picturesque, appear on the whole rather vague and far-fetched. Similarly, the methods of treatment recommended to the practitioner would in these days not enable the fifth year student to pass his examinations; but for purposes of comparison, and in order to emphasize the need of accurate observation among our students of the present day, I have placed in parallel columns the signs and symptoms of the more important poisons mentioned in the Chinese classics and in modern Western text-books, and in a second table certain methods of treatment recommended in both:—

Poison.	*Symptoms, Hsi Yuan Lu.*	*Western Text-books*
Croton Oil ...	Dry mouth, flushed face, great weariness, heart-burn, continuous diarrhœa.	Abdominal colic, vomiting, purging, features pale, pulse weak and small.
Arsenic	Burning in throat, vomiting and purging, swollen lips, mouth, abdomen and rectum, vesicles on tongue.	Nausea, continuous vomiting and diarrhœa, pain in abdomen, cramps in legs.
Alcohol	Distension of stomach, vomiting, diarrhœa, unconsciousness.	Face flushed, livid lips, congested eyes, sweating, convulsions, coma.
Belladonna ...	Dry throat, discomfort, feverishness, convulsions, signs of madness.	Dry throat and skin, flushed skin, temperature raised, pupils dilated, delirium.
Caustic Potash...	Hair all disarranged, scratches and marks on body, fingernails broken.	Signs of corrosive poisoning, gastro-intestinal irritation.

Methods of Treatment:

Poison.	*According to Hsi Yuan Lu.*	*Modern Methods.*
Arsenic ...	Beat up 20 eggs, mix with 3 drams of alum and give to patient. After a while, use 4 ounces of blacklead powder ground on stone.	Induce vomiting with stomach tube or emetic, give milk and eggs, and ferric hydrate or dialysed iron.
Croton Oil ...	Abundant bean water, rhubarb and gentian, lily buds, arrowroot powder.	Induce vomiting, give demulcent drinks, relieve pain, administer stimulants.
Opium	Give blood of duck or pigeon, force fæces down throat to induce vomiting, wet body with cold water, open mouth with chopsticks, avoid sunshine.	Induce vomiting, give hot coffee, administer solution of potasssium permanganate, dash cold water on face, inject atropine sulphate, practise artificial respiration.
Charcoal gas ...	Give green radishes, dash cold water on face, remove patient into fresh air.	Fresh air, artificial respiration, stimulants.
Gold	Give fat from camel or donkey which can soften gold (sic), purge with calomel, give bird's flesh to envelope the gold and convey it out of bowel.	Not mentioned.

It is interesting to see that the Chinese believe that gold can produce death if taken by the mouth. In the past, emperors and high officials have been known to swallow gold and have died. Death in such cases was probably due to some other poison, such as opium, wrapped inside the gold leaf. In my own practice I have come across two Chinese ladies who tried to commit suicide by taking gold. In one case the gold was in the shape of a ring, and in the other a piece of gold leaf rolled up. In each case the patient survived and there were no bad after-effects.

In North China, where the open charcoal stove, or the earthenware stove for burning coal balls consisting of a mixture of coal dust and mud, is used, deaths from carbon monoxide poisoning are quite common. Very often, among the lower classes, a whole family is suffocated in one room. The natives in this part of China eat the large green radish as a means of prevention, and at night-time, just the most inconvenient time physiologically for the ingestion of hard indigestible things, hundreds of boys and girls may be seen devouring large slices of this radish, which they regard as a sure preventative against suffocation by "coal gas."

A face powder consisting of white lead which is extensively used throughout North China among women, especially actresses, is frequently swallowed for purposes of suicide. It produces the same symptoms as those noticed in ordinary lead poisoning.

Practitioners in China are all acquainted with cases of opium poisoning, which used to be the most frequent cause of death by suicide. Recently, owing to the difficulty of procuring opium, aniseed has come into fashion, especially in Central China. I am informed by Dr. Main that the principal symptoms of poisoning by aniseed are a feeling of weariness, weakness in upper extremities, nausea, and convulsions. If the aniseed is taken with wine, bleeding from the mouth and nose occurs. Belladonna is another popular poison, resorted to by kidnappers, seducers, and occasionally cooks who wish to poison their employers.

The above notes are only a superficial study of a most instructive branch of medicine in China, and any medical colleague interested in the question may derive some amusement from the few books dealing with this subject which are now on display among my collection of ancient Chinese medical publications.

WU LIEN TEH.

THE DIFFERENTIAL LEUCOCYTE COUNT AMONG THE CHINESE.

Reprinted from the China Medical Journal, May, 1915.

I have often been struck with the relatively low percentage of the finely Granular Oxyphile cells (Polymorphs) and the high percentage of the Hyaline cells and Lymphocytes in the blood of the Chinese, when compared with the English standards.

So early last year, at the Shantung Road Hospital, Shanghai, the leucocytes of 57 males were counted. The subjects were apparently healthy people, consisting of doctors, dressers, servants, my own friends, and my friends' servants. Their ages averaged 30.9 years; the oldest was 60 and the youngest 17. They were all Chinese. The average period of residence in Shanghai was 11½ years; the longest being 36 years, and the shortest 0.1. The blood was taken at all times of the day.

The counts were taken in lines, at right angles to the long axis of the slide, as recommended by Rogers; 300 cells were counted in all cases except 4. Of these 4 cases, 400 cells were counted in 1 case, and 200 cells each were counted in the 3 other cases.

To differentiate the Hyaline cells from the Lymphocytes, those that were equal in size to or larger than an average Polymorph were classed as Hyaline.

Here are the standards given by two authorities:—

	Schafer.	*Hutchinson and Rainy.*
Finely Granular Oxyphile	60-70 %	70 %
Coarsely ,, ,, ...	1-10 ,,	2-4 ,,
Basophile	rare	0.5 ,,
Hyaline	5 ,,	2-4 ,,
Lymphocyte	15-30 ,,	22-25 ,,

The results obtained at the Shantung Road Hospital were:—

		Average.
Finely Granular Oxyphile	43-77.5 %	58.3 %
Coarsely ,, ,, ...	0.3-19.6 ,,	5.7 ,,
Basophile	0.0-3.3 ,,	0.6 ,,
Hyaline	1.3-20.6 ,,	9.8 ,,
Lymphocyte...	11.5-38.6 ,,	25.3 ,,

The Arneth counts as worked out between the Americans and the Filipinos proved to be different, and different too between Americans in America and American residents in the Philippine Islands.* It is interesting to speculate whether the cause of these blood changes is climatic or dietetic, or whatnot.

NOTE.—Chamberlain and Vedder (1911), during their investigations in the Philippine Islands on the effect of a tropical climate on white men, performed 72 Arneth counts on American soldiers, and for comparison fifty on natives of the island. Their work led them to the conclusion that "the average Arneths picture showed a marked drift to the left in the case of Filipinos, and a slight drift in the same direction for American residents more than one year in the Philippines."—ED.

J. W. H. CHUN,

Senior M. O.

THE DIFFERENTIAL LEUCOCYTE COUNT IN BERI-BERI.

In text books very little attention is paid to the blood in Beri-beri. They are mostly silent with regard to the microscopical aspects of the blood, some pass them over with a short sentence or two. Castellani and Chalmers merely mention that the blood does not show much abnormality beyond a certain amount of anaemia.

It is proposed to record the differential leucocytic counts in 42 cases of clinically recognised Beri-beri seen at the Shantung Road Hospital, Shanghai, during the year 1912. The blood was taken as opportunity afforded and not in sequence of all the cases that came to the hospital.

It was noticed that more cases came for treatment during the summer months. The patients were all male Chinese, mostly young adults, and many were soldiers from the Taoyin yamen. Most of them confessed to have lived in crowded and insanitary rooms.

The acute "wet" type formed the largest number of the cases. Their chief symtoms were swelling or numbness or both of the legs, while some complained of weakness of the lower extremities.

In doing these counts one was struck with the relative increase in numbers of the hyaline cells. It is true that this feature is not solely confined to Beri-beri, for in malaria, as is well known, the hyaline cells increase in numbers relatively. In the cases investigated, malaria was excluded by the absence of history and by the normal size of the spleen.

The blood was taken generally at two or three o'clock in the afternoon. In doing these counts the slide was moved slowly in lines at right angles to the long axis of the slide, while the cells were being noted. Three hundred cells were counted in each case.

To differentiate the hyaline cell from the lymphocyte, those that were equal in size to or larger than an average finely granular oxyphile were classed as hyaline.

In a communication (1) published by the author it was shown that the white cells in the blood of the Chinese are different in

relative numbers from those of the European. One can see why the white cells in the blood of a beri-beri case are again different from those of the normal Chinese in that the hyaline cells are increased relatively in numbers. The differential counts in the three cases may be tabulated below so as to show the difference.

The standards given by two British authors are:—

	Schafer.	*Hutchinson and Rainy.*
Finely Granular Oxyphile	60-70 %	70 %
Coarsely ,, ,, ...	1-10 ,,	2-4 ,,
Basophile Leucocyte	rare	0.5 ,,
Hyaline	5 ,,	2-4 ,,
Lymphocyte	15-30 ,,	22 25 ,,

Differential count published by author as being that of a normal Chinese:—

Finely Granular Oxyphile	58.0 %
Coarsely ,, ,, ...	5.7 ,,
Basophile Leucocyte	0.6 ,,
Hyaline	9 8 ,,
Lymphocyte	25.3 ,,

The differential count obtained in the above-stated 43 cases of Beri-beri:—

Finely Granular Oxyphile	57.4
Coarsely ,, ,, ...	5.2
Basophile Leucocyte	0.4
Hyaline	19.5
Lymphocyte	17.2

It may be noted here that the hyaline cells average as high as 19.5% wheras the normal figure among the Chinese ought to be 9.8.

This noticeable high percentage of the hyaline cells may serve as a help towards the diagnosis of Beri-beri in difficult cases.

Furthermore as the aetiology of Beri-beri is still so obscure, the fact that the hyaline cells are relatively increased may act as a support to the theory that Beri-beri is a disease caused by protozoa, seeing that in other protozoal diseases such as malaria, Kala-azar, and trypanosomiasis, the percentage of the hyaline cells is augmented. In Castellani and Chalmers' book under rhe heading "Biological Causes of Beri-beri," it is stated "a great many observers are in favour of a biological cause for the disease, without committing themselves as to whether it is animal or vegetable.....Scheube considers it is an infectious, but not a contagious disease, and says that the analogy with malaria is in some respects striking....." Some observers have found plasmodia in the blood, some protozoa in the urine, and others again haematozoa in the blood.

Castellani and Chalmers conclude by saying "to summarize from the evidence, it appears more likely that a parasite will be found to be the spreader of the disease, which makes it more probable that the actual cause will be found to be a protozoon than that it is due to diet, which, however, may be a predisposing cause, especially if the nutritive value of the food is low, or the proportions wrong."

Reference.

1. The China Medical Journal, Vol. XXLX No. 3.

J. W. H. Chun,

Senior M. O.

A REPORT ON THE PREVALENCE OF EYE DISEASES IN THE GOLD MINES OF HEILUNGKIANG.

I have the honour to submit a Report on my visit of inspection to the gold regions in Huma District in order to study the causes of eye-disease there. In this report I have tried to follow as closely as possible your instructions.

I left Taheiho on August 7th, at 5 p.m. by the S. S. Measle, arriving at 4 p.m. on the next day at a place named Kumarou (庫瑪爾), which is about 400 *li* from Taheiho up the river. The steamer anchored at this place to load firewood for an hour.

Kumarou is a depot for supplies destined for Yu Ching Kou (餘慶溝), and its distance from the latter is about 120 *li* by over-land route. The population at this place is estimated at about 200 and there are one small Japanese and two Chinese Medicine shops, also a few Japanese and Chinese prostitutes.

The steamer left Kumarou at 5 p.m. and arrived at Huma at 9 p.m. on August 8th.

Huma is about 480 *li* from Taheiho and situated on the southern bank of the Amur just opposite to a Russian village name Ushakova. Huma is a depot for supplies for Hsing Lung Kou (興隆溝), and has a population of about 1,400 There are altogether about 400 buildings, most of them being built of wood. There are:—one Magistrate's Yamen, one Police Station, one barrack with 50 soldiers, one Commercial Guild, two Japanese men, (most probably quacks), one Chinese Dentist, 4 Chinese quacks, 6 Chinese medicine shops, one small theatre, 7 Japanese brothels with about 50 girls, and 185 Chinese prostitutes.

There is one Chinese medicine shop called (共立醫院) which is supported by funds subscribed by Hsing Lung Kou and the Commercial Guild. Its yearly expenditure is estimated at about 1,000 roubles, and there is one Chinese quack appointed to this institute. This shop, called a hospital, charges prostitutes an examination fee of Rs. 1.00 each per month.

As this place is too low and its area too limited on account of the surrounding hills, the Magistrate is going to remove his Yamen to a place called Kuchan (古站), about 30 *li* from Huma down river. At Kuchan there have already been built

about 50 shops and one Yamen, and more buildings are expected to be completed within this year.

After my arrival at Huma, I put up in a Chinese hotel and then went to call on the magistrate Mr. Suen Yen Tang (孫燕堂), but found he had gone to Kuchan. On the evening of August 9th, having heard that Mr. Suen had returned from his journey, I went again to visit him and applied for an official letter introducing me to the Director of the gold mine so as to enable me to travel more easily in the mines. In the Yamen I met Mr. Chang Ching An (張敬庵), Director of the Hsing Lung Kou, whom I had met once before in Taheiho. He told me that he had to return to his station also, and suggested my travelling with him in the early morning of the August 11th. But from August 10th heavy rains poured down until August 12th., and we had to postpone our proposed journey.

At 6 a.m. on August 13th, each of us engaged a 2-wheel cart and started for Hsing Lung Kou in a south westerly direction. We travelled over hills, and reached a place named Nan Ch'uan Tze (暖泉子), at 9 a.m. Its name is derived from a small spring measuring 1 × 1 × 2 feet, the water of which never freezes even in the severe days of winter. The water I tested then was cold, but it is said to be warm in winter. In this place there are only a few inns and a barrack with about 20 soldiers. We rested ourselves in an inn for about 10 minutes and resumed our journey. At 10.30 a.m. after crossing a river, we reached an examination station called Erh Tao P'an Cha (二道盤查), situated on the south bank of Hu Ma Er Ho (庫瑪爾河), which, it is said, extends from Kumarou to Mo Ho. We stayed at this station for two hours, and started on our journey again at noon. At 5 p.m. we passed another examination station San Tao Pan Cha (三道盤查), and arrived at our destination, the chief station of Hsing Lung Kou, at 9 p.m. This place is about 120 *li* from Huma.

On August 14th. Director Chang sent one of his soldiers to accompany me to the place where miners were working for gold. After having satisfied myself about the methods of mining, I examined some of the miners, and in the afternoon I went out again with a soldier to see their quarters. Here I attended 2 cases of malaria and 2 cases of dysentery. In this mining area there were about 200 miners, and I examined about 100 of them. I found that at least 70% of them were suffering from

Granular Conjunctivitis. That night Mr. Chang told me that in those mines belonging to Hsing Lung Kou, there were altogether about 5,000 miners, divided as follows:—

Hsi Wu Lo 〔西烏勒〕	400;	Pei Shi Li 〔北 習 力〕	400;
Wa Hsi Li 〔瓦習力〕	300;	Po Hsi Li 〔博 西 里〕	800;
Wei K'o Ta 〔倭克達〕	100;	Nao Te Yi 〔奧 得 益〕	50;
Tu Wu Hsi 〔都渥喜〕	400;	Hsing Lung Kou 〔興 隆 溝〕	200;
Te Sheng Kou 〔得勝溝〕	80;	Ch'uan Sheng Kou 全 勝 溝〕	80;
Chin Lung Kou 〔金龍溝〕	300;	Chi Lung Ta Kou 〔吉龍大溝〕	50;
Hsi Yi Na 〔喜宜納〕	1000;	Chi Lung Chih Kou〔吉龍枝溝〕	300;
Hsing Chiang Kou〔興江溝〕	50;	Tung Hsing Kou 〔東 興 溝〕	20;
Chi Hsiang Kou 〔吉祥溝〕	200;	Chin Sheng Kou 〔金 升 溝〕	200;

From this table I learned that the biggest place was Hsi Yi Na, which I determined to visit first.

At 9 a.m. on August 15th., Mr. Chang ordered a soldier to accompany me to Hsi Yi Na, and after coming 30 *li* from Hsing Lung Kou we arrived at a branch station, Pei Shih Li (北習力), where I intended to stay for a day or two on my return. After resting and feeding our ponies, we left for Chi Lung Chih Kou (吉龍枝溝), which we reached at 4 p.m. The distance from Pei Shih Li to Chi Lung Jih Kou is 40 *li*. The chief of the station sent his inspector to go with me to examine the miners. I noticed only one gambling saloon in this place. I examined about 60 miners and found about 40 of them affected with Trachoma. I met also 1 case of corneal ulcer and 1 case of pannus; the latter had been bad from time to time for 2 years. I spent one night in that place, and at 7 a.m. on August 16th, left Lung Chih Kou for Hsi Yi Na. After travelling from hill to hill for about 60 *li* we arrived at Hsi Yi Na at 1 p.m.

Hsi Yi Na is thus 130 *li* north west of Hsing Lung Kou.

On the day of my arrival at Hsi Yi Na, the chief of the station and his inspector went together with me to examine the miners. I examined about 200 of them and found that in at least 70%, their eyes were in an unhealthy condition. There were also 3 cases of malaria, 1 case of corneal ulcer, and 1 case of pannus.

On August 18th. I went with a soldier to visit a neighbouring mine Tu Wu Hsi, 8 *li* from Hsi Yi Na. I examined about 20 miners and found 13 of them suffering from trachoma. The conditions of their quarters were the same as in other places.

Having spent 3 days at Hsi Yi Na, I left at 9.30 a.m. on August 19th, and reached Pei Shih Li at 5 p.m. As the chief of the station was absent, I went out with my soldier to see the miners' quarters, and found them as dirty and smoky as elsewhere. I spent one night in that place, and the following morning, August 20th, started on my way back to Hsing Lung Kou.

From the day of my arrival at Hsing Lung Kou, it rained continuously for 3 days. At 6 a.m on August 23rd, I left Hsing Lung Kou for Huma which I reached at 9 p.m. of the same day.

On August 24th. I went to see the Magistrate Mr. Suen and told him what I had seen during my inspection.

At first I also intended to visit Yu Ching Kou but as my time was limited, I was obliged to put it off, and returned by S/S Sodoronika to Taheiho, which I reached on August 26th.

There are 5 Chinese gold mining companies on the Amur, namely Moho (漠墨河金廠), Hsing Lung Kou, Yu Ching Kou, Chi Chin Ho and Tai Ping Kou. The number of miners employed by each company are so numerous and uncertain that it is impossible to ascertain the facts unless I inspect them all personally.

All the above mentioned mining companies are Government owned except Yu Ching Kou which is worked jointly by Government and merchants (官商合辦).

The distance of each of the mines from Taheiho and the average number of miners in each are as follows:—

Up river	Yu Ching Kou...	(餘慶溝)	410 *li*	about	3,000 miners.
„	Hsing Lung Kou	(興隆溝)	500 „	„	5,000 „
„	Moho.....	(漠　河)	1,200 „	„	2,000 „
„	Chi Chin Ho.....	(奇乾河)	1,560 „	„	1,400 „
Down „	Tai Ping Kou....	(太平溝)	550 „	„	2,000 „

Methods of mining.—The method universally adopted in Chinese gold mines consists in washing the earth in a wooden apparatus with water from a stream directed towards it by a long wooden furrow.

This apparatus consists of 2 oblong wooden open boxes communicating with each other; one being placed horizontally and the other slopingly. The horizontal or upper portion measures 5 ft. by 2½ ft. and has on each lateral side a board about 10 inches high; one of the narrow ends is bound by a piece of board, whilst the other opens into the upper part of the sloping portion of the

apparatus. The floor of this horizontal box is accurately fitted with a piece of wood plank or iron, about 1 inch thick, in which are a number of holes about the size of a twenty-cent piece. This sieve-like portion can be removed when required. The lower or sloping box measures 9 ft. by 2½ ft. and is similarly guarded on both sides by a piece of board, its upper end communicating with the free end of the horizontal portion, while its lower end is free. The floor of this box, unlike that in the horizontal one, has cross pieces of wood laid in at short intervals which may be detached when desired. Each portion of the apparatus is looked after, sometimes by one and sometimes by 2 coolies.

When a certain place is known to contain gold, the miners first dig up the earth layer by layer, and as soon as they reach the layer containing gold, they carry the earth on a wheel barrow to the apparatus.

The earth is conveyed to the horizontal box of the apparatus and one man stands by with an iron shovel to stir the earth to and fro aided by the stream of water which flows down from above. Thus treated, the mud is washed away, and sand and gold dust are deposited in the lower layer of the box, having escaped through the holes into the floor of the horizontal box. The stones, sand and gold dust which cannot pass through the holes, are further broken up and led by a shovel to the sloping box of the apparatus, where the earth is filtered once more by means of the cross pieces of wood. As a result, gold dust in the sand sinks through the intervening spaces. The stones and unbroken pieces of sand are then scraped to the lower part of the sloping portion and removed.

At the end of the day the miners take out the sievelike floor and the transverse pieces of wood, collect the deposit and wash it again in a shallow wooden basin. They first shake the basin with water so as to allow the gold dust to sink down to the bottom. The basin is gently moved to and fro on the surface of water. By this means all the sand and small pieces of stones are washed away and gold dust is deposited at the bottom of the basin.

Modes of living among miners at Huma.—The huts occupied by miners are of the same type in all the mining areas. The walls are made of logs of trees packed close together and the roofs are made of a wooden frame work covered with paper. In one hut a gang of 10 to 15 miners generally live together with a rough iron stove placed in the middle of the room for cooking purposes and

for heating in winter. Their beds are made of small sized tree stems laid close together, and are about 6ft. by 2ft. in size. The reason why they build their huts so low is that they want to keep their quarters warm and burn as little firewood as possible. Firewood sold in mining areas is very dear.

As soon as it is ascertained that gold may be dug successfully in a place, those miners, who have some capital, proceed to the spot with some of their men and start to erect a hut. These men are called head coolies (把 頭). Before they reach the land where gold may lie, the head coolie has to supply food daily to his followers and buy the mining utensils, etc., needed. As soon as gold is obtained, he is entitled to 10% of the quantity of gold and the remaining 90% is divided among his followers. If they can work out gold on the spot to their satisfaction, they continue to stay there, but if the output is limited and not satisfactory they go away and try their fortune elsewhere; thus the head coolie has to suffer any loss accruing from food and other expenses, etc. Once they leave the place, the hut is considered to be Government property, and if they return later, they cannot claim back the hut to live in if it is occupied by others. Another reason why the miners build their quarters so poorly is because they are not sure how long they will stay in the place.

They work from daybreak to sunset and have no relays.

In Summer they take usually 5 meals a day. The first meal consists of bread, millet-gruel and some vegetables in the early morning at their quarters; second meal, only congee taken at about 7½ a.m.; third, meal-bread and congee taken at about 11 a.m.; fourth meal, bread and tea at 4 p.m.; and the last meal, bread, vegetables and congee taken at their home when work for the day is finished. After the third meal at 11 a.m., they rest for two hours and resume work at 1 p.m.

Of course, those who have good luck in the day, always buy some pork, tinned goods and eggs as luxuries; in those places where the number of miners exceed one thousand there are always small retail shops, meat stalls, and bath houses. Flour, wine, oil, millet and beans are sold under monopoly by the mining company. Only third quality flour can be bought in mining areas, and its price varies from Rs. 4.20 to Rs. 5.00 per pood in different places.

Each miner consumes on an average 2 poods of flour in 26 days, and it is said that the monthly cost of a miner's food

amounts to Rs. 14,00; besides this, he has to pay "one gold" as Government fee every month. Therefore a miner, a farmer, or a wood cutter must earn, at the least, 18 roubles a month before he is able to exist in the mining areas. The miners' earning capacity depends upon their luck, and I am told that the majority of them earn about Rs. 50.00 a month.

They have no recreation. When a place has a few hundred miners or more, there are always some gambling saloons, but no prostitutes or even women could be found in the mining areas except in one place, Hsi Yi Na, where a Korean woman together with her husband and children own a washing house. In this place there are also 8 Koreans working in a section mine given to them by the mining company.

Trees—As trees are most important for building huts and for burning purposes, it is impossible for any operation in a mine to be started without trees at hand. Fortunately most of the hills in Manchuria, especially in places in the Amur region, are covered with trees, and while mines exist near hills, the miners are amply supplied with wood.

Water-supply—Miners obtain their water supply from any source near their quarters, sometimes from water flowing over hills but generally from a stream met with in the digging of mines. It is said that when miners live far away from their working place, they get their water supply from wells.

Prevalence of Disease—The percentage of eye diseases among miners is very high. I should say that at least 70% of them are sufferers from granular conjunctivitis.

In the mining areas there is absolutely no one to look after the sanitary condition of the quarters, and the director Mr. Chang told me that in the mining areas it was impossible to talk about the word sanitation, because any kind of expenditure incurred in his mines must be first sanctioned by the Board of Finance before it can be spent, otherwise the Government would not pay for it; many ordinary expenditures, such as demands for repairing bridges and roads which are the most important factors in the mines, were often rejected by the higher authorities. Therefore any improvement in the sanitary condition of the mines requiring money can not be expected.

Their cause—With regard to the causation of eye disease, I do not think it is caused by the dust of the mines, because

mines are situated on low ground, and the place where gold is dug, is always damp with no dust flying in the air from the mines

In view of the smoky and filthy conditions of the miners' quarters and their partly underground work in winter I suggest that the disease germs of granular conjunctivitis infect them indirectly through their dirty clothes, and fingers, because everyone rubs his eyes with his fingers or sleeves, as soon as his eyes are irritated e.g. by smoke in a smoky place. The microbe effects its entrance into the eye, and therefore a man first infected with the disease always complains of itching about his eyes, especially around the canthus. The more irritation there is the more he scratches his eyes with his dirty hands, nails etc., and as a result, the eye trouble is aggravated.

When I was in the mining area, I met no other interesting cases, except a few cases of malaria and dysentery. No one showed any signs of ankylostomiasis.

Symptoms—The symptoms usually complained of by patients suffering from Trachoma are itching and sometimes watering in their eyes on exposure to wind. The case is easily recognized by the presence of granules in the upper and lower eyelids especially around the canthus. Once pannus, corneal ulcers, or iritis supervene, the patient usually experiences severe pain in the diseased eye, and this generally radiates into the affected side of the head.

Facilities for Treatment—When miners are sick, they usually receive no medical treatment, but sleep and rest to wait for natural recovery, because most of the mining places have not even a Chinese medicine shop. Perhaps they will look for medical assistance, when the disease is well advanced, because it is not an easy thing for them to travel to Huma on account of the long distance. Besides they know that they cannot get any good physicians even on reaching Huma. These are the reasons why so many badly advanced cases of eye disease are seen at our hospital at Taheiho. The season which favours the development of eye diseases is spring.

Quacks for treatment of eye diseases in gold mines.—There are no quacks practising in the mines. Though I have been to 5 mining areas, I saw in Hsi Yi Na only one small Chinese medicine shop. Surely he can never cure any eye complaint or diseases of any kind, and will do more harm than good if he

tries. It is a difficult question to control this kind of practice, because there will be no medical assistance to miners at all if we place any restrictions upon them.

The principal local officials.—They seem progressive and are willing to adopt modern medicine, but they all say that on account of the limited powers they possess, they can promise nothing regarding contributions for our medical assistance. The Magistrate Mr. Suen told me that the best way to obtain funds for establishing and maintaining a hospital is for the Chief Medical Officer of the Three Eastern Provinces to send an official letter to the Governor of Heilungkiang, informing him of the conditions of the miners and asking him to instruct the mining companies at Huma to appropriate some money for the purpose. When the superintendents of the gold-mines receive official instructions from the Governor, they will take the necessary steps. He further added that all he could contribute at present was about Rs. 1000 a year , and that this money which was partly subscribed by the gold mines and partly by the local commercial guild, was now being used for maintaining a Chinese Medicine shop (共立醫院) at Huma.

Output of mines.—The superintendent Mr. Chang would not give me the accounts in detail, but simply supplied me with an estimate of the net profit of his mine during the last three years since he was appointed to the mine. In 1913 a profit of Rs. 170,000.00 was made; in 1914 Rs. 180,000; and in the present year Rs. 360,000.

Gold dust is prohibited from being taken out of the mining areas by miners, and must be sold to the mining company on the spot where they work. Gold obtained in different places shows a different percentage of pure gold, and therefore its price varies in different mining areas. In Hsing Lung Kou each gold piece (一個金) weighing maces 1.166 is sold to the mining company at the price of Rs. 4. 60; and at Po Hsi Li Rs. 4 40. The market price for 1 gold at Taheiho is about Rs. 6.00. I am told that this year all the mining companies on the Amur have prospered, especially Hsing Lung Kou, which will double the profit of the preceding years.

Machinery for gold mines.—The director of Hsing Lung Kou says that machinery is not good for these mines at Huma at all. because gold may exist sometimes for a few yards and then finish. In one place it may be obtained a few feet deep and in another at more than 10 feet deep. I do not accept his words as reliable, because

he is simply an old style scholar, confining himself all day long to his office, and I believe he has not inspected or even seen any machinery operating in mines in Russia or elsewhere. I said to him "Suppose I buy machinery for use in your mining areas, will this be welcomed?" He replied that would not do because the Government had not made out any regulations concerning gold mining with machinery. He further added that the Government would most probably reject this method of mining, because he thought that the Government's policy in operating mines in Manchuria was to swell the number of immigrants from China in order to strengthen the territory, and that, if machinery were universally used for mining operations in the mines the immigrants from Shantung would have nothing to do. I have been informed nevertheless that the Kwang Hsin Company will soon introduce machinery into their mines.

Inhabitants.—Most of the local people are miners and have immigrated chiefly from Shantung. They seldom settle down in the mining areas; as soon as they make a few hundred roubles, they return home before the river closes. The natives of the soil are called No Lung Ch'un (鄂 倫 春), Manchurian banners, and are found living in the hills. They do not work in the mines but hunt all the year around. When I was on the way travelling from one mine to another, I occasionally met some of them carrying badger flesh (豹 子 肉) with them on horse back. I did not meet a single rich man who had settled in the mining areas.

Recommendations.

a.—Strict attention should be paid to the miners' quarters; healthier quarters erected; no cooking allowed in their living quarters, and the mining company should build a kitchen for every 10 huts. Their quarters must be swept every day, and in summer, doors and windows must be opened all day in order to admit sunlight and fresh air.

b.—All miners must be forced to buy at least 2 or 3 suits of mining clothes and 2 towels. These things must be sold to them at cost price. They must get their clothes washed every two days and the towels every day. Miners must wash their faces and hands every night and take a bath every 2 days. In this case a sufficient number of bath houses must be built by the mining company and a nominal charge of two kopecks made for use each time.

c.—In order that everything may be properly done a sanitary inspector, who has been trained in Harbin Hospital for at least 2 years, should be appointed to each of the mining areas. The Mining Company now employs street inspectors (稽　查), in nearly all the mining areas, whose duty is simply to look after the miners, coming and going. In this case I suggest that in order not to increase the expenditure of the mining company, the Sanitary Inspector appointed should act also as street inspector.

d.—A hospital should be established at Ku Chan because that place is the centre of the two mines—Hsing Lung Kou and Yu Ching Kou.

e.—Whenever any of the miners complain of itching in the eyes they must consult the sanitary inspector. A simple case of Trachoma may be treated on the spot by the inspector, but if the case is complicated with pannus or corneal ulcers or iritis, he must be sent at once to the hospital for treatment. Further improvements may be made as time goes on. The confidence of the miners must first be won, and for this purpose the Sanitary inspector may give simple lectures in the evenings.

Other Diseases.—No other interesting diseases have been observed in the mining areas except a few cases of malaria and dysentery. I am told that malaria is very prevalent in summer, but when I visited the place, the disease had nearly passed away.

I am told that when Hsing Lung Kou was in the Pei-yang Mining Company's hands there were some physicians stationed at every mining area. When any of the miners became blind they received a compensation of Tls. 50.00 each from the mining company, and were sent back to their respective homes once a year accompanied by a soldier. At present nothing is done for them, if they get sick or blind. A farmer in Hsin Lung Kou who had been suffering from malaria for 3 months could find no medical assistance until I saw him.

C. H. Luk,
Medical Officer-in-charge.

Taheiho Hospital,
Sept. 15, 1915.

REPORT ON EYE DISEASES AT TAHEIHO.

(*1916-17.*)

The gold-miners in the Amur regions are nearly all affected with Trachoma, the only important eye-disease here. This affection has special features so far as my experience teaches. Compared with the Tientsin and Canton trachoma, it is characterized by its greater malignancy, greater tendency to recidives, greater liability to cornea complications, little tendency to cicatrization and hence no Symblepharon, etc., and lastly by its great resistance to treatment. In about 20% of the cases the disease is accompanied by acute catarrhal inflammation caused by the Koch-Weeks's bacillus and is called *Acute Trachoma*, which often leads to corneal or catarrhal ulcers. These catarrhal ulcers invariably lead to perforation of the eye-ball followed by panophthalmia, causing complete destruction of the eye. That is why we often hear of the gold-miners recounting the rapid destructive evolution of the disease. Indeed the trachoma in these regions can compare pretty well with the same disease in Egypt where it has caused so much misery among the population. Unhappily the authorities here are not kind and merciful and do not heed the counsels of hygiene. The Officials here adopt a *laissez-faire* policy toward trachoma, the American Government relying upon the prevalence of trachoma as a pretext against the entry of Chinese into the United States. I propose the following measures:

1. During the summer season when the river opens, a physician (specialist not required) should proceed to the mines, make an inspection and treat the cases accordingly.
2. Public lectures and pamphlets should be issued instructing people in the elements of precautionary measures against eye infection.
3. Prohibition of the use of common towels in the Chinese theatres and elsewhere. Keining's method of treatment and a strong where solution of copper sulphate seem to yield the best results.

Interesting Eye Cases Seen.

Chiang Yu Sang (姜雨生) aged 28, admitted Feb. 15, complains of not being able to see with his left eye clearly for many years and unable to close his left eye for a few months. In January a chancre appeared on the penis followed later by all the secondary symptoms of syphilis. Now he has facial paralysis and his orbicularis palpebrarum has lost its function. Right eye:—Skiascopy reveals a distinct shadow moving inside the pupil in the same direction as that of a concave minor, Conclusion: *Simple Myopic Astigmatism* with the *Rule* AV ½. Acuteness of vision ⅓ without correction. On correction with cylinder—250 axis horizontal.

Left-eye: The eyelids cannot be closed, the conjunctivae are affected with subacute angular Conjunctivitis. Skiascopy reveals Simple Myopic Astigmatism with the Rule. AV½.

Correction with cylinder—0.75 AV raised to 1.

Wong Tah Shing, aged 35, admitted Sept. 20, complains of inability to see with his left eye for 7 months. He had a chancre on the penis in the twelve month of last year only three weeks' from his last act of sexual intercourse. Eight days after the appearance of the chancre, buboes on both sides appeared but did not run to suppuration. On February 10 of this year roseola appeared all over the body except the face with symptoms of syphilis, *e.g.*, headache, particu arly in night time, pain in the bones, sore throat, falling of the hair and mucous patches at the angle of the mouth. His eye trouble commenced with redness, frontal headache, photophobia, lacrimation, and the vision at that time was already dim.

Objective Examination by right eye:—Both conjunctivae are affected with trachoma. The left eye lacrimates abnormally and on pressing the internal angle where the lacrimal sac is situated a large quantity of pus came out. The sclerotic is colored dark brown, characteristic of syphilis lesions.

Focal Illumination:—Cornea transparent, anterior chamber effaced or very shallow, texture of iris dirty not clear, iris bombed like a tomato, pupil does not respond to light, accomodation and convergence, consensual reaction is lost, borders of pupil firmly adherent to crystalline lens, central part of crystalloid

anterior is opaque, and examination by Direct Ophthamoscopy, Skiascopy, Direct and Indirect methods are impossible, Tension O. No projection sense.

Conclusion:—The patient had syphilitic iritis with complications as posterior synechiae, causing Occlusio and Seclusio pupillœ and anterior cortical cataract. The exudates in the vitreous humour must have contracted pulling the retina and causing the *Detachment of the Retina* which is the cause of the *absence of Tension* and of the *Projection Sense.* With the absence of projection sense the case will not be benefited by any iridectomy as his retina is detached. The case is therefore pronounced *incurable.* But treatment can be instituted for his *trachoma* and *lacrymal sac.*

Sysanoff aged 28, complains of pain in right eye for 5 months. In her 14th year she had attacks of tertian malarial fever for a duration of 3 years. Last year she had attacks of acute articular rheumatism with fever, pain all over the body but localised pain in the wrist and elbow joint with formation of rheumatic nodules on the fingers, remnants of which can still be seen. The attacks were accompanied by swelling and redness in the joints. Locomotion was impossible owing to the severe pain. A few months ago she commenced to have pain in the right eye, followed by a gradual loss of vision but not accompanied by any signs of acute inflammation. She noticed also a formation of a thin white veil through her pupil.

Physical Examination:—Auscultation of the heart reveals weakness of the sounds of the heart but no sure signs of endocarditis.

Eye Examination:—Conjunctivae normal. Lacrymal apparatus normal Sclerotic somewhat enlarged and thin as compared to the normal eye and the appearance through it of the blue choroid coat. The Choroid coat corresponding to the thinning point of the sclerotic is about 7 millimeters in length and 4 millimeters in width, it is therefore of an oblong shape. The thinning point is situated on the upper external part of the eyeball one or two millimeters behind the posterior margin of the cornea.

Focal Illumination:—Cornea clear and transparent but somewhat bulging; anterior chamber very deep; pupil widely dilated and its borders are atrophied and thinned, reaction is lost to

convergence, light and accomodation, consensual reaction is lost, texture of iris very clean and clear; the crystalline lens completely. opacified. Skiascopy impossible. Direct Ophthalmocopy impossible. Fundus examination impossible. Projection sense lost. Quantitative and qualitative vision all lost.

Conclusion:—This is a very rare disease, ocurring in young and particularly female subjects, characterised by rapid evolution, the severe intermittent pain, the gradual loss of vision if not treated in early stages, the thinning of the sclerotic and the appearance through it in the choroid. Its name is Sclero-choroiditis Anterior or Suprachoroiditis. The cause in 9 out 10 cases is rheumatism. The pathological process causes increased secretion of physiological fluid in the interior of the eyeball causing a heightening of the intraocular tension whence the thinning of the sclerotic. The rheumatic poison has polluted the refractur media and normal eye fluids, resulting in a cataract known by the name of *Choroidien cataract.* The heightening of the intraocular tension causes the lamina cribosa—a weak point—to bulge backwards at the same time pressing the optic disc and causing atrophy of the nerve whence the loss of quantitative and qualitative vision and also the loss of pupillary reactions.

Treatment:—Nothing can save the vision; the case is too advanced. Removal of the choroidien cataract will be of no avail. All we can do is to relieve intermittent pain by the internal administration of salicylates at the same time as a prophylactic against the disease in the left emmetrope eye. After 6 doses of salicylates the severe pain was relieved and the patient could resume work as usual.

CHU YUK FEN.

Taheiho, 1st May, 1917.

A SUMMARY OF REPORTS FROM THE HARBIN, SANSING LAHASUSU, AND TAHEIHO HOSPITALS FOR THE YEARS 1914, 1915, 1916.

Staffs

Harbin Hospital.

In May 1914, Dr. C. S. Lin assumed duty as Resident Medical Officer in place of Dr. Y. T. Liu who was transferred to Lahasusu. When Dr. Liu resigned, Dr. Lin was sent to replace him and Dr. T. F. Lin was appointed to Harbin.

Nurse Ung Sung Ung joined the Hospital in the autumn, Dr. Reynolds, the bacteriologist, resigned in December.

In January 1915, Dr. J. W. H. Chun joined the Hospital as Senior Medical Officer. Dr. S. P. Chen resigned in May. Dr. T. N. Tang was transferred from Sansing to Harbin and Dr. T. F. Lin went there to replace him.

In July, Dr. Shih Chi Liang was appointed to Harbin, and Nurse Chen Lin Chin Tsai joined in place of Nurse Ung who was transferred to Taheiho.

In 1916, Dr. Eberson, bacteriologist, joined in May. Dr. Tang came in place of Dr. Lin. Nurse Chen Chi Ching replaced Nurse Chen Lin Chin Tsai who left for Taheiho.

Sansing Hospital.

In 1914, Dr. T. N. Tang was in charge.

In 1915, Dr. Tang and later Dr. T. F. Lin was in charge.

In 1916, Dr. T. F. Lin and later Dr. T. N. Tang was in charge.

Lahasusu.

In 1914, Dr. Y. T. Liu and then Dr. C. S. Lin was in charge.

In 1915, Dr. C. S. Lin and later Senior Dresser Wu Hsi San was in charge.

From 1916 onwards, Senior Dresser Wu Hsi San has been in charge.

Taheiho.

In 1914, Dr. C. H. Luk was in charge. Later, Deputy Female Medical Officer Yeh Chen Ping Tuan joined to take charge of the female patients and to undertake the inspection of prostitutes.

In 1915, Dr. C. H. Luk was in charge. Later Dr. Hu Shih Liang joined him, and Dr. C. S Lin proceeded there to replace Dr. Luk who obtained six months' leave to study tropical medicine under Sir Leonard Rogers in Calcutta. Nurse Ung Sung Ung was appointed to Taheiho.

In 1916, Dr. Y. F. Gee, who studied ophthalmology in Bordeaux, joined the staff in Taheiho in the autumn to study the cause of the frequency of blindness among the coolies in that region.

Chen Lin Chin Tsai was appointed to Taheiho in place of Nurse Ung Sung Ung who returned to Harbin.

STUDENT DRESSERS.

Boys of about 16 years of age join the Harbin Hospital first of all to be trained as student-dressers; after a year or two they may be transferred to any of the out-stations. They go through a period of probation for six months, after which they receive a salary of Rs. 11 per month. The medical officers in Harbin give them lectures in elementary medicine and surgery, first aid, dispensing and other practical work. Promotion is made, as a rule, once a year until a maximum of Rs. 45 per month is reached after 7-8 years, when they become first class Senior Dispensers and "are expected to have a satisfactory knowledge of hospital routine work, ordinary dispensing and sanitary work. In this category are classed Sanitary Inspectors whose work will be outlined by the Chief Medical Officer for assisting the Public Health authorities."

ATTENDANCE.

Out-patients.

The out-patients are seen on week-days at 10 a.m. They may come any time before 9.30 to be registered by a student-dresser. Those able to do so are asked to pay 20 kopecks, and a slip of yellow paper is given to each with his name, age, and number written on it. They then have precedence over those who cannot pay and who have numbered white tickets only.

Patients who come any time after 9.30 must pay one rouble. No money is charged for medicine. Accidents and emergency cases are seen at all times of the day free of charge.

Customs employees are treated free, and Chinese staffs of different firms, including the Chinese Post Office, come to the Hospital for medical attendance according to arrangement.

The number of out-patients seen each year at the several stations may be put down as follows:—

	1914	1915	1916
Harbin.	1,7954	1,5626	1,1549
Sansing	4712	1997	3193
Lahasusu	...	1124	1042
Taheiho	1127	1977	2436

The above include first entries (male and female). As a matter of fact, male patients predominate in numbers; in Harbin at least, the women coming to about 10% daily only. In Taheiho, the female patients are in larger proportion.

Occasionally we are invited to go out to attend maternity cases in their own homes. As a rule, they are cases of difficult delivery, delayed for 2 or 3 days, and after the Chinese midwife has done her worst.

In the summer nearly 100 % more patients come for treatment than in the winter, owing to the incidence of seasonal diseases such as Typhoid, Dysentery, and Diarrhoea, etc. Further, the patients can then travel more easily and comfortably by water. Then also, there are more coolies in Manchuria, for with the summer come coolies from the south.

Apart from ulcers and other surgical cases, venereal diseases head the list in numbers, digestive troubles come second, owing to the fact that the average coolie eats only twice a day, and when he eats he likes plenty, thus causing dilatation of the stomach and indigestion. Then tuberculosis of the bones and lungs, eye and skin diseases come in their order.

In Taheiho, the eye diseases head the list, as the workmen in the gold mines near that region often develope trachoma and become blind, owing to the insanitary and filthy conditions under which they have to live.

In-patients.

Patients who ought to have treatment in the hospital are admitted at the rate of 30 or 40 kopecks a day according to the food required. No charge is made for operations or for medicine. Better class patients can have separate rooms and pay Rs. 2 daily. Patients must pay a month's "rice money" in advance and must have a guarantee from some shop.

The medical officer in charge of the Sansing hospital reported that three Austrian prisoners of war who escaped from Siberia were admitted at the request of the local authorities in the winter of 1915, and three more were admitted in 1916. Their condition was pitiable and some whose feet were frozen had to undergo amputation of their gangrenous parts.

The records of the Harbin Hospital in-patients show the following:—

	1914	1915	1916
Medical cases	39	27	39
Surgical cases	116	159	181
Scarlet fever	1	...	...
Small pox	3	...	4
Chicken pox	...	...	1
Typhus	1	2	1
Mumps	...	...	1
Erysipelas	2	...	4
Relapsing fever	...	2	...
Total	162	190	231
Surgical operations under anaesthetics	...	179	163

The in-patients are mainly surgical, and this is another evidence of the belief that Western surgery is more appreciated than that of the Chinese.

In looking at the in-patient book, one is struck with the large number of patients who were wounded or sustained fractures either from accidents or from attacks by friends or robbers. Bullet wound cases number not a few.

Next come the diseases of the rectum and anus, as many cases of fistula-in-ano and of piles were treated. Tuberculosis of the bones comes third.

Many major operations were performed successfully, thus gaining the confidence of the people, and many patients come long distances to be treated. The average patient is a coolie who comes from Kuan Li (south of the Great Wall) born either in Chihli or Shantung. He is a sturdy, strong, and healthy specimen of humanity, courteous, grateful for services rendered, and courageous and long-suffering wherever pain is to be borne.

Pathological Laboratory in Harbin.

In the laboratory Drs. Wu and Eberson have conducted very interesting researches on plague immunity. Among routine laboratory work, clinical diagnoses are made and

pathological specimens preserved for the museum. Regular examinations of water and milk supply are also made for public and private purposes. Dr. Chun and Dr. Shih have made a systematic examination of the faeces of the in-patients, whenever this could be obtained. The results are here set in tabular form :--

	Numbers examined	Percentage
Total number of cases examined	220	...
No parasitic eggs seen	163	74.09
Some form of parasitic eggs seen	57	25.91
Ascaris	42	19.09
Trichocephalus Dispar	5	2.25
Botheriocephalus Latus	3	1.36
Ascaris and Trichocephalus	2	.09
Ascaris and Bothriocephalus	1	0.45
Ascaris and Trichoma Intestinalis	1	0.45
Ascaris and Ankylostomum Duodenale	1	0.45
Taenia Solium	1	0.45
Ankylostomum Duodenale	1	0.45

The figures tend to show that the poor people in Manchuria are not so heavily infected with intestinal worms as they are in China Proper, owing to the fact that they do not use human excreta for manure, as the ground is fertile, and that there are no paddy fields to be cultivated. The people grow no rice, but import it mainly from Japan.

They all eat vegetables and "mantao," a kind of bread made from excellent local wheat or millet known as Kaoling.

Noticeably ankylostomiasis is not abundant. Four cases of *bothriocephalus latus* infection were noted. This is not remarkable seeing that river fish is exceedingly plentiful and cheap at all times.

Only one case of *taenia solium* was seen. This is remarkable as the percentage of infected pigs may be put down roughly as 10%. A big cold storage company (The Produce Export Co.) in Harbin cause all their pigs to be examined by a veterinary surgeon before they are passed, and they find that 10% of all the pigs examined show a "measly" character in some part of their carcases.

It may be that the thorough way in which the meat is cooked protects the consumer. Furthermore, the average coolie eats very little meat indeed.

Fuchiatien (Chinese Harbin) and Taheiho.

It is worthy to record here that during 1916 the town of Fuchiatien has undergone a tremendous change for the better in the way of sanitary reform. Magistrate Chang (張) has caused

four main roads to be macadamized and widened, and has also helped to construct a road connecting the town with Russian Harbin, so that the muddy roads which disgraced the town are now things of the past. Accumulation of filth and rubbish in the immediate vicinity of the town is prohibited, and they are carried some miles out to be disposed of. The previously smelly area situated just outside the town is purged and now boasts of a good road.

This tendency to cleanse the town is a sign of good times and helps to make the place compatible with the exceedingly large business that is carried on.

During the year (1917) and the next, more roads are to be made and the town will be extended eastwards along the Sungari river.

Magistrate Chang also asked us to examine the Chinese practitioners of Western medicine in Fuchiatien, so as to safeguard the welfare of the people. As a result only one out of eighteen candidates passed.

In some such way, we have helped the local authorities who are wont to seek our advice either in matters of public health administration, or some point in medical jurisprudence, or such other services that a medical officer of health can give.

In Taheiho also, under the enlightened administration of Taoyin Wang (王仕) new roads have been made and the town kept clean. The prostitutes of the place undergo a systematic examination at our hospital where a resident female medical officer is stationed specially for this purpose, and supported from funds provided by the police authorities.

J. W. H. CHUN.
Senior Medical Officer.

THE CENTRAL HOSPITAL OF PEKING.

Reprinted from the Modern Hospital (America).

(April No., 1917).

One of the modern enterprises that are attracting wide attention in the new Republic of China is the Central Hospital of Peking, which is to be financed and controlled entirely by Chinese. The inhabitants of this ancient land are known to be very conservative, especially in matters of medicine and public health, and the establishment of this model hospital is a reminder to America that her sister republic is forging ahead. The trustees of the hospital have employed Messrs. Shattuck and Hussey, the Chicago architects, to devise the plans and superintend the construction. The roof of this hospital is now on, and it is expected that the opening will take place some time next autumn.

General Description—The hospital is situated in the west city on the main Ping Chih Men Street; the site was presented for the purpose by the Ministry of the Interior. Several odd lots in the neighborhood, as well as the old houses situated in that locality, were purchased at a total cost of $21,000. The ground is high, being nearly 3 feet above the level of the street. The whole site is of the shape of an irregular quadrilateral, wider in the south than north. The building stands on the front part, while the back or northern part, with many strongly built old houses, will be kept for future purposes. The famous "Temple of Imperial Ancestors" lies next door to the present hospital, and its many fine tress will be a great asset.

The type of building devised is distinctly American, consisting of a basement floor, the windows of which are at least 6 feet above the level of the ground and three floors above this. In front is a projecting wing for the main front door, whilst at either end is a bipartite wing with an intervening veranda containing the main third class wards and their solariums. The roofs of the wings are used as flat roof gardens. The shape of the building was finally decided upon in order to obtain the maximum of light with a minimum of exposure to northern winds in winter, and also to

meet the objection of Chinese patients to rooms facing direct east and west. The whole building is 262 feet broad, an average of 90 feet deep, and 65 feet high.

The ground plans are mapped out in the form of a straight wide rectangle facing north and south, with a central corridor running from east to west. In front, facing the south, is the projecting wing for the front door and reception rooms; behind, to the north, are the three wings of the boiler room (with the operating theatre above) in the middle, and a unit of the third-class general ward on either side; while at the eastern and western ends are bifurcated wings forming the main third-class ward with a solarium occupying the space between the forked pieces. The corridor is 8 feet wide, and practically all rooms lead directly into it. Besides the electric lift, one central and two lateral staircases connect the various floors, and a fire escape runs from one floor to another through the eastern and western solariums.

Basement Floor.—The entrance for out-patients is situated in the eastern wing. The central corridor runs in a straight line from here to the western wing. The rooms lying south of the corridor are: one men's and women's waiting room with toilets (capable of accommodating 200 persons altogether), medical room, genito-urinary room, gynecological room, dental rooms, disinfection room (with adjoining bath and locker rooms), massage and electrical department, linen room, special kitchen, ordinary kitchen (for cooking Chinese meals). To the north of the corridor are, respectively : dispensary, store room for drugs, surgical and bandage rooms, ophthalmic rooms, emergency operating rooms, emergency operating rooms, emergency laboratory, boiler and fuel rooms, general store room, x-ray and photographic rooms, chief attendant's room, and attendants' room (with accommodation for 35), with toilet and shower baths. The veranda between the kitchen and attendants' room will be used as a dining room for the lower staff.

First Floor.—The front door steps lead to a portico and a main reception room, on the right of which is the inquiry office, and adjoining this is the superintendent's office. Behind this are the central staircase and the lifts, one on either side. Across the corridor one steps into the board room (for meeting of trustees, etc.,) and clerks' room, from the doors of which a fair-sized veranda situated above the fuel room may be reached. Going toward the east wing lie a series of second-class private wards, facing the

south, each capable of accommodating two patients, while the large third-class general ward with space for 25 beds occupies the whole of the forked wing. The rest, a model general ward unit, consisting of a bath room, toilet room, service room, linen room, laboratory, isolation ward, diet kitchen and sister's room, is placed on the north side of the corridor. On the west side, the general ward unit and private wards are arranged in the same way.

Second Floor.—The second floor is divided up in the same way as the first floor with the exception of the central part. Immediately above the reception rooms are situated first-class wards, each capable of holding one patient and possessing separate bath rooms and toilets. On the other side of the central corridor is the operating theatre unit, consisting of a sister's room, an anteroom, a preparation (anesthetic) room, a sterilizing and wash rooms, operating room (with space for a movable auditorium), and a recovery room. The wings on either side of this are arranged in the same way as on the first floor, namely, second-class private wards and third-class general wards and units. The wards on this floor are intended for surgical male and female cases

Third Floor.—The central portion of the third floor is reserved for first-class wards containing private verandas. On the east are situated quarters for the superintendent and assistant medical officers, while the western wing is divided up into large analytical and bacteriologic laboratories where routine and research work will be carried out. The forked extremities with space for sixty beds serve as roof gardens for patients requiring the sun treatment.

The building is of gray brick with a roof of red tile. The total number of beds will be about 150. The whole hospital is of fireproof construction, being the first building of its kind in the capital. Both the cement and the iron rods used are of Chinese manufacture, and considerable discounts have been allowed by various firms for this charitable undertaking. All the wards will be laid with Walton linoleum, and a hot water installation will be adopted for heating. The Customs Board has allowed materials ordered for the hospital to come in duty free, while the railways have charged half rates for conveyance. Most of the surgical and bacteriological instruments, costing over $25,000, have been presented by government institutions. When the building is completed next spring, the total cost will surprise the most critical in its moderation. It is expected that the whole building and equipment will cost a quarter of a million dollars. The hospital

being mainly a voluntary establishment, the most rigid economy will be enforced in all directions consistent with efficiency, and it is hoped that the success of the scheme may induce other cities in China to move and so spread modern medical science through the length and breadth of this great land.

The resident medical staff of the hospital will be chosen from the most promising Chinese who have graduated from medical schools of different countries, including China. The visiting physicians will consist of specialists living in the capital who may desire to coöperate. The nursing staff will be Chinese, with a sister in charge of each unit.

Included in the Central Hospital scheme is a clinic in the southern, more crowded, section of Peking, where paying and other patients may be seen and sent to the large hospital in case of need. For this purpose a motor ambulance service will be established. It is also proposed to build a sanatorium on the western hills, to which the convalescent patients may be sent. The land required for this purpose has already been granted, and the trustees are only waiting for some charitable donor to provide the necessary funds, amounting to $15,000, for starting the work.

NOTES ON ANTHRAX IN NORTH MANCHURIA.

"Anthrax may be defined as an infection due to specific bacilli which may attack every species of domestic animals and for this reason may become one of the greatest scourges of animal life. Man is by no means immune, although fortunately, the malady as it appears in the human subject is usually less acute than the form seen in cattle and sheep. This is probably due to the fact that the lesions in man occur most frequently from infection of the surface of the hands or feet, while cattle and sheep are more likely to swallow the infectious germs with their food, thus giving the germs immediate entrance into the animal system, where they can exert their most harmful influence without check or control. Historians record an outbreak of Anthrax in the south of Europe in 1613 which started with the cattle and spread from them to the populace, ultimately becoming a veritable scourge and causing the death of more than 60,000 people. From this it is evident that the disease was far more virulent and far more inclined to attack all species of mammals during these earlier centuries than at the present day. It is even recorded that many deer and other varieties of game animals were destroyed during these early periods." *Washburn in U. S. Agricultural Bulletin 439.*

In Russia and Siberia the disease has been known for a long time and is called "Sibierskaya Yasva" and in previous decades, before control of it was established, swept the Baikal and other regions so disastrously that it imposed a very serious problem upon colonisation work in these districts.

Prevalence in Manchuria.—When work was first begun in the Sungari Valley in 1913 something was heard of the "Horse Plague" which had been known in the region for many years and which had at times nearly devastated the country of its animals.

In 1913, however, as it was an unusually dry season, we saw very little of it; but in 1914 we lost about 50% of our stable and in 1915 not only a similar proportion of our stock but also six of our labourers from some disease, which the local farmers said was related to the "Horse Plague." It was the diagnosis of the disease by the medical officers of the Manchurian Plague Prevention Service which enabled us to take the necessary precautions.

In 1915 one of our neighbours lost 55 horses from a drove of 60 odd; another lost his whole stable of 7; while from the regions a little further away reports came telling of many similar instances. This summer, although not so virulent, the disease

was present throughout our region. It was interesting also to learn from some Fishskin Tartar hunters that in certain years they have found in the woods large numbers of carcasses of wild animals, especially deer and wild boar, which had evidently died during the summer or autumn. As this is a region where marshes and wet black loam lands abound, it is probably fair to infer that this is a present-day confirmation of the statement of Mr. Washburn regarding the plague of 1613.

Horseflies and Anthrax.—It is a common saying among the Chinese peasants that the bites of horseflies often cause disease and even death. Although we secured no microscopic proof of the presence of Anthrax bacilli on the horsefly, it is frequently stated that infection is carried by insects, so that the connection between the horsefly season and Anthrax seems sufficiently established. One authority says: "Buzzards and other birds, dogs, and even flies may also carry the infection from such sources in uninfected localities." The Sungari Valley, especially in its lower reaches, is infested during the greater part of July and August with 2 or 3 large varieties of the horsefly which attack the stock unless they are protected. As the flies only come out some hours after daylight and largely disappear with the sunset, some of the farmers use their animals during the night.

Preventive Measures in 1916.—After your identification of the disease in the autumn of 1915 we arranged to bring out from the Cutter Laboratories in San Francisco small supplies of vaccine and serum. Then in the spring of 1916 through the courteous assistance of General Horvat, Director General of the Chinese Eastern Railway, we secured from the Russian Government station at Blagovestchensk a liberal quantity of their No. 2 vaccine and their serum. In addition to this Dr. Frank C. Hershberger, the Veterinarian in the Service of the Heilungkiang Government, whose services you secured for us last summer, brought us another 100 doses on June 18. On the 19th one of our riding horses developed a large pustule on the shoulder. Although it is generally considered dangerous to vaccinate when the disease has already made its appearance, we decided to do so at once after careful examination of our stock to see whether any of them had abnormal temperatures. On the 20th and 22nd we vaccinated over 40 head of our own animals and during the remainder of the month some 20 or 30 belonging to our neighbours.

Of the American vaccine the dose prescribed is 1 c.c. and of the Russian only ½ c.c.; each with 10 c.c. of serum. The process used was first to inject subcutaneously on one side of the neck the serum, carefully washing with antiseptic solution before and after injection, and then, when all the herd had been so treated, to go back and inject the vaccine on the other side of the neck. After vaccination, the animals, we were told, could be lightly used for the first 3 days but that they should be given no exercise from the 4th to the 7th days; and it was advised that none be exposed to horsefly bites until 10 to 14 days had elapsed to allow of complete immunization. Of all animals vaccinated for ourselves and our neighbours only one died, this probably owing to the fact that she was a mare with colt and was badly exposed to horseflies on the 7th day after vaccination. In one or two cases additional doses of serum were administered. In one of these we experimented on a sick animal with 1 c.c. vaccine instead of ½ c.c. and found pustules developing on the breast, which were reduced by the additional dose of serum.

This high percentage of immunity secured was very gratifying in view of the fact that many losses occurred among unvaccinated herds in our neighbourhood and across the river behind Fu Chin Hsien; and that we began our preventive measures quite late. For safety and for the best result vaccination should be made, according to the authorities, form 4 to 6 weeks before the usual date for the first case to appear. Although the disease among animals in these districts sometimes seems to run into the late autumn and winter, it does not usually appear in spring until some time in June, usually after the 15th., when warm sunlight fosters the activity of the spores which develope best on low grounds which have been covered with snow, water or overflow from a river and are warm and partially dried, making a rich bed for the succulent low land grasses. Although the local peasants understand nothing of the germ life behind the disease, their wonderful empiricism has taught them that their animals contract the disease by feeding on these marsh grasses. It would consequently be desirable to finish all vaccination work by May 15th; and from a standpoint of practicability it would perhaps be better to do the work in March and April before the spring plowing is started.

Curative Measures in 1916.—Although we used rather rough and ready methods and did not observe scientifically

the specific case of the disease itself, the following cases may be quoted:—

Case I. Riding horse developed large pustule on shoulder June 19. Dr. Hershberger injected 50 c.c. of serum and one hour later lanced and cleansed pustule with strong solution of Potassium Permanganate. Without further attention recovery was complete in a fortnight and later cut healed very clean. Microscopic slides made from the discharge from this pustule showed very clearly the bacilli in large numbers, while rats and squirrels injected with the discharge were killed in 24-45 hours.

Case II. Mare with colt vaccinated June 22nd. Driven to Shore Farm on night of 29th, when there were large numbers of horse flies. Within 24 hours internal swelling developed in throat, breathing became difficult and caused death before doctor arrived.

Case III. Black mule of Farmer Tuan doing contract plowing for us. Animal badly emaciated and pulled down by work. Pustule on neck and breast.

31 Aug.	A.M.	106°F—Injected 60 c.c. serum.
	P.M.	103°
1 Sept.	A.M.	104°
	P.M.	105°
2 ,,	A.M.	105° —Injected 40 c.c. serum.
	P.M.	104°2
3 ,,	A.M.	102°
	P.M.	104°8—Found owner had taken animal out and walked it one hour under mistaken direction.
4 ,,	A.M.	102°6
	P.M.	102°8
5 ,, 2	P.M.	101°2
7 ,,	Noon	100°6—Released cured.

Swelling on breast became very hard on the morning of Sept 3rd. Decreased in size during the day but at night was still hard. On morning 4th felt like flat piece of cork. When the animal came to us it was so weak that it walked with sitff legs and only when pulled or pushed along.

Case IV.—White horse from our own stable in excellent condition showed swellings on breast and between legs.

1 Sept.	P.M.	102° —Injected 65 c.c. serum.
2 ,,	A.M.	100°
	P.M.	102°
3 ,,	A.M.	99°6
4 ,,	P.M.	99°8
	P.M.	100°8
5 ,,	P.M.	99°8.
7 ,,	Noon	99°6—Discharged cured.

This horse never showed any signs of disease, *e.g.* loss of appetite, weakness.

Human Case.—In November, 1914, before we know what we were fighting, a labourer developed a large pustule on the neck and ran a temperature between 104 and 105. Without experience we guessed at the disease as some form of blood

poisoning and by poulticing vigorously we drew out large quantities of dark blood and some matter. After 2 or 3 days of constant treatment of the pustule and of careful regulation of the diet and the bowels the pustule decreased until almost normal and the fever dropped to 99.

After one day of normal conditions and returning appetite we began to feed him carefully and gave strict orders that he should receive nothing except from our hand. That evening, however, the man watching him yielded to his craving for food and had a large meal of macaroni prepared for him about 10 oclock. The next morning his fever rose steadily until death ensued within 24 hours.

In 1915 six more labourers died. They were in the habit of skinning their dead animals and using the hides as moccasins, and tails as fly switches.

In February, 1916, another case developed in which the pustule appeared as usual on the neck and spread far down on the breast. Frequent applications of Iodine were used right in the open wound and externally with the gratifying result that the man recovered. At this turn of affairs the other labourers said this man "was too strong to die."

We have had no human cases since we secured the serum and can consequently give no personal experience. Mr. Eichhorn, Chief of the Pathological Division of the U. S. Department of Agriculture, in Bulletin No. 340, published in December, 1915 writes:—

"Extensive data are available on the effectiveness of Anthrax serum for the treatment of the disease in man. It is recommended that from 30 to 40 c.c. of serum be injected in three or four different places, Should no improvement follow in 24 hours an additional injection of 20 to 30 c.c. serum should be administered. In most instances the results are very favorable, and this treatment is acknowledged to be superior to any other mode of treatment known for this disease."

In the summer of 1917, vaccine and serum were used by Dr. Herschberger to immunise animals. A large proportion escaped the disease but some developed anthrax. It was quite possible that the presence of spores accentuated the severity of the infection.

SUMMARY OF THE SECOND ANNUAL GENERAL REPORT.

Harbin, 15th October, 1914.

TO HIS EXCELLENCY,
THE MINISTER FOR FOREIGN AFFAIRS,
PEKING.

SIR,

I have the honour to submit a brief summary of the Second Annual Report of the North Manchurian Plague Prevention Service for the year ending 30th September, 1914.

2. Owing to the limited accommodation allotted to us at the Customs buildings, I asked for, and obtained, on May 15th, permission from Your Excellency to rent separate quarters to carry on the administrative portion of our work. This appears to me advisable in view of the fact that the Customs themselves are in need of all available room in their buildings. Our new offices are now situated at 63, Balshoi Prospect.

3. I left Harbin on June 2nd on a tour of inspection to our hospitals on the rivers Sungari and Amur, and also to formally open, on behalf of the Government, the new hospitals at Sansing and Taheiho.

The official opening of the Sansing Hospital took place on June 17th although patients had been treated there since June of the previous year. This hospital consists of six separate blocks, each measuring 60 feet by 25 feet. The ground occupies a square area measuring 260 feet each way, and surrounded by a thick wooden structure 10 feet high. The hospital has accommodation, in time of crisis, for at least 60 patients.

The Taheiho Hospital was declared officially open on July 19th by the Acting Taoyin of the district, though it had received patients since the previous October. The principal Russian Officials of Blagovestchensk, including the Frontier Commissioner, attended the function. This hospital consists of an imposing two storied building, on the ground floor of which are situated laboratories, out-patient departments, an operation room and a

dispensary, and on the upper floor are placed the living quarters of the Medical Officers. Behind this building are two Isolation Blocks, each capable of accommodating at least twelve patients. There are out-houses for stores and attendants and also an ice-house. All these buildings are substantially built on solid granite with stone foundation 7 feet deep. Two Medical Officers (a male and a female) are at present stationed at Taheiho.

I returned to Harbin on 31st July.

4. During this trip to the stations on the Sungari and Amur, I was able to realise the pressing need of medical science among the people. The natives of the soil, principally Manchus, are completely ignorant of the elements of personal hygiene, and numbers are consequently carried away every year by small pox, tuberculosis and other infectious diseases. The immigrants consisting mostly of Shantung coolies, though robust and industrious, are easily attacked by eye diseases when working in the gold mines which abound in the Amur region. This is largely due to their ignorance of the dangers arising from eye trouble, to the want of adequate protection against blindness in the mines, and to their not seeking proper medical aid until it is too late. From personal investigations made on the spot, I understand that hundreds of these miners become totally blind within a few months of their arrival in the district. This seems to me an economical loss of the first magnitude, and I propose to station, in the near future, a Medical Officer at Aigun well qualified in eye diseases. To obtain complete success, however, it is most necessary that our local authorities and mine owners should co-operate with and follow the advice of our medical officers regarding the introduction of hygienic measures into the mines (where they work) and the inns (where they live), as well as in the adoption of modern scientific methods of treatment.

5. The frequent outbreaks of infectious disease amongst cattle and horses in Manchuria should claim the serious attention of our authorities. Apart from the fact that some of the diseases attacking animals are closely related to man, a study of their nature is most interesting and will do much to promote knowledge and relieve the distress caused to farmers and agriculturists by the loss of their animals. For over two years I have asked for the appointment of a veterinary surgeon well versed in research work, and an expert from abroad had almost been appointed in July on

behalf of the Heilungkiang Government, when lack of funds put a stop to the negotiations. In this connection I may mention that whilst at Taheiho last summer, I and Dr. Reynolds, the bacteriologist of the Service, carried out some preliminary investigations on the parasites infesting the cattle and sheep of that region.

6. I am pleased to report that an interesting experiment—probably the first one in China—has been made in the appointment at Taheiho of a Female Medical Officer who will have charge of the public women, numbering nearly two hundred, in that prosperous town. Hitherto, the returns of sexual diseases have been unusually big, and our Medical Officer has been instructed to do all they can in preventing their dissemination. In this work I wish to acknowledge with gratitude the willing co-operation of the Taoyin, Mr. Chang Shao Tseng (張壽增) and the other local officials who have striven to assist us in our work. I may also record two noteworthy examples of friendly co-operation, namely, a monthly contribution of Rs. 150 from the police authorities, and one of Tls. 40 from General Shuang in charge of the forces at Aigun, for medical assistance rendered by our Service. I earnestly hope that this praiseworthy example of the authorities at Aigun will be followed in other places where our Service has shown its beneficent work.

7. The number of cases treated during the past year by the different hospitals of our Service may be given here.—

Harbin Hospital	... ...	19,167
Sansing „	... ...	4,139
Taheiho „	... ...	7,548
Lahasusu „	... ...	1,830

These include many major operations and serious accidents.

The greater number of in-patients were completely cured.

8. The complete Annual General Report of 1911-13 mentioned in my last Report has been published. The English portion, including maps, photographs and coloured plates, was undertaken by the Cambridge University Press, whilst the Chinese portion was printed by the Commercial Press of Shanghai. Both firms have done their work creditably and I am happy to say that the Report has been received with much praise by the leading scientific journals of Europe and America.

9. The following comprise the principal members of the Service at present:—

Dr. Wu Lien Teh, M.D., B.C., (Cantab), LL.D., Director and Chief Medical Officer.
Dr. R. de Luca (Commissioner of Customs), Lay Director and Treasures.
Dr. Chen Szu Pang, M.B., B.C., (Cantab), Senior Medical Officer Harbin.
Dr. F. E Reynolds, M.B., Ch.B. (Edin.), Bacteriologist to the Service,
Dr. Luk Chun Hsuan (Graduate of Peiyang Medical College) Assistant Medical Officer, Taheiho
Dr. Tang Tsung Nin (Graduate of Peiyang Medical College) Assistant Medical Officer, Sansing.
Dr. Lin Chia Suei (Graduate of Army Medical College, Tientsin) Assistant Medical Officer, Lahasusu.
Dr. Yeh Chen Ping Tuan, Female Medical Officer, Taheiho.
Dr. Ling Ting Fan (Graduate Union Medical College, Peking) Assistant Medical Officer, Harbin.
Mrs. Tsao Feng Hui Ch'ing, Matron Harbin Hospital,
Mrs. Ung Sung Ung (Graduate of the Women's Medical College, Foochow) Sister, Harbin Hospital.
Mrs. Chang Hsi Tseng, Principal Dispenser Harbin Hospital.

Two Medical Officers have left the Service, viz. Dr. Ts'uei Chang Shan on 15th June 1914, and Dr. Liu Yi Teh on 25th September, 1914. Their places have been taken by Dr. Lin Chia Suei who joined on April 15th, and Dr. Ling Ting Fan who joined on September 11th.

10. In order to encourage good continuous work and to improve generally the prospects of Medical Officers of the Service, a new scale of salaries has been drawn up by me after consultation with the Lay Director and Treasurer. Under these new Regulations, our Medical Officers will be entitled, after some years of faithful service, to a regular leave of some months to enable them to take up a post-graduate course in Europe or America (in the case of Senior Medical Officers) and in Hongkong, Shanghai or India (in the case of Assistant Medical Officers.)

11. During the last year I have been honoured with a Chia Ho Decoration, III class, by the President who has also kindly, on the recommendation of the Minister of Education, appointed me as one of the eight original Members of the Academy of Letters of China. Seven of the Chinese doctors who worked under me during the plague epidemic of 1910-11 have received the IV class Stanislaus decoration from the Czar of Russia. These are:—

Dr. Chuan Shao Hsing	(卿紹全)	Now Director of the Army Medical College, Tientsin.
Dr. Chung Ching Hsi	(溪清鐘)	Chief of the Medical Department, Kirin.
Dr. Lei Hsu Jung.....	(榮樹黎)	Medical Officer at the President's Office.
Dr. Fang Chin.....	(擎　方)	Surgeon-General in charge of the Medical Department War Office.
Dr. Hou Yu Wen.....	(文毓候)	Now Private Practitioner at Peking.
Dr. Yao Chi Yuan	(元啟姚)	Chief of the Medical Department, Mukden.
Dr. Sun Pao Lu	(璐寶孫)	Chief of the Government Hospital, Tsitsihar.

12. I regret to state that a large number of out-patients who attend our hospitals at Harbin, Sansing and Taheiho, show signs of the morphine habit which they have learnt through the indiscriminate selling of this drug by foreign druggists and others. Out of 617 cases treated this year in the prison attached to the Kirin Bureau, as many as 301 were for this complaint. Our officials have everywhere been most active in preventing the spread of this pernicious habit, but the hearty co-operation of foreign consuls residing in these parts in controlling the importation of the drug by their nationals into Manchuria is required before any substantial progress against this vice may be expected. It is earnestly hoped that the enforcement of proper laws after the ratification by all the Powers of the world of the Opium Convention signed at the Hague in 1912 will definitely stamp out the habit.

13. Besides ordinary routine work, our Medical Officers at Harbin have undertaken a series of investigations upon the action of Neo-salvarsan (914) upon syphilis, and have performed the Wassermann test for this disease in most cases. In addition, we have made an analysis of several anti-opium medicines and others for the local authorities. I record with pleasure the loyal co-operation of the medical staff under me in spreading the benefits of modern medicine among the people. The work of educating the public with the desirability of conforming to new and improved ideas of Public Health and Sanitation, to which I referred in my last Report, has made decided progress, and I have been able to obtain the consent of the Minister of Education in Peking to the introduction of elementary books of various grades on Hygiene and other public health matters, into our schools and colleges. I feel sure that the only way in which the public of China may be enlightened in regard to the remarkable progress which the west has made in the prevention and cure of all forms of disease by up-to-date sanitary laws, well equipped hospitals and an improved system of medical education, is through early instruction on these matters both at home and in the school room. A marked step in this direction has been taken last September by the Board of Communications in the adoption of my recommendations on the enforcement of sanitary regulations on the different Government Railways.

14. I am happy to state that although plague has in the past year occurred in South China, India, Hongkong, Russia, Japan, America and other parts of the world, not one case has been

observed in Manchuria. This makes the fourth consecutive year in which this dread disease has not made its appearance in these Provinces since the epidemic of 1910-11.

15. In conclusion, I wish to express my gratitude to the Chinese Government Railways and the South Manchuria Railway Company for their courtesy in allowing me free passes to travel on their lines. I am indebted also to the Customs officers at the various stations in Manchuria for assistance rendered to members of our Service, and to the medical staff of the Chinese Eastern Railway for information always willingly given.

I have the honour to be, etc.,

(Sgd.) WU LIEN TEH.

SUMMARY OF THIRD ANNUAL GENERAL REPORT.

Harbin, 20th September, 1915.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a brief summary of the Third Annual General Report of the North Manchurian Plague Prevention Service for the year ending 20th September, 1914.

2. In my second Annual General Report, I drew attention to the existence of outbreaks of epidemic disease among cattle and horses in Manchuria, closely related to man, and asked for the appointment of a Veterinary Surgeon from abroad, who could devote his time to the elucidation of this problem.

I have now the pleasure to state that the Taoyin of Aigun requested me on 3rd November of last year to wire for the services of a qualified Veterinary Surgeon from America. I willingly accorded to the request of the Heilungkiang Government, and as a result Dr. Frank C. Hershberger, Doctor of Veterinary Medicine, Missouri, U.S.A., was appointed to the post, and took up his duties as from January 1st of this year. Dr. Hershberger is stationed principally in the Aigun District, but his duties may carry him to other parts of Manchuria, where animal diseases exist and require special study. The total appropriation, amounting to nearly Rs. 10,000 (ten thousand roubles), is borne entirely by the Heilungkiang Government and is a praiseworthy attempt to deal with the pests affecting valuable domestic animals.

3. Sixteen cases of Bubonic Plague (with thirteen deaths, occurred in October, 1914, in the Transbaikal Provinces, 75 kilometres west of the Chinese frontier town of Manchouli. It may be remembered that the great Pneumonic Plague of 1910-1911 originated near this spot, and more cases occurred during the autumn of 1911 in the same neighbourhood. Plague made its appearance during the past year in the southern provinces of China, in Japan, India, Siberia, Hongkong, Shanghai and elsewhere, but Manchuria

remained entirely free. This makes the fifth consecutive year in which the pest has not occurred throughout these Provinces.

The need of exercising the strictest vigilance over this much dreaded disease, wherever it may be reported, is apparent to all, and I have to record with gratitude the close co-operation of the medical staff of the Chinese Eastern Railway, headed by Dr. Jasensky, in this respect.

4. At the request of the Committee, I attended the biennial Conference of the China Missionary Medical Association which was held in Shanghai this year from 1st to 6th February. A prominent place was reserved in the Exhibition Hall for the display of scientific exhibits contributed by the North Manchurian Plague Prevention Service. They included among others: —

a—Gross pathological specimens connected with Pneumonic Plague.

b—Microscopical specimens of the same.

c—Stuffed marmots, tarbagans and skeletons.

d—Mounted specimens of insects and worms, causing disease among man, cattle and other animals found in North Manchuria.

e—Instruments and appliances for the prevention and contro of Plague.

f--Books, pamphlets, models and other materials used by the Service for the spread of popular knowledge on hygiene and sanitation.

g—Drawings, photos and lantern slides on Plague and other infectious diseases.

These exhibits attracted much attention not only from the doctors but also from the intelligent classes of the community who were admitted for one week after the close of the Medical Conference. I had the honour of reading a paper on "Awaking the Sanitary Conscience of China" before the full Session, and also delivered one of the three popular lectures in connection with that Conference. My subject on this occasion was "The Manchurian Plague and After." A splendid feeling of comradeship between the foreign and Chinese physicians prevailed at the Conference, and Chinese representatives were elected to serve on the newly created Council on Public Health and Council on Medical Education. If the participation of the members of our Service contributed in any way to the marked success of this Conference. I am satisfied, because the number of western-trained medical men in China is

still small, and good efficient work in the prevention of Plague and other epidemic diseases can only result from a closer union between foreign and Chinese medical practitioners residing in all parts of the country.

At the special request of the officers of the Medical Association, our exhibits have been lent to them as part of a travelling museum for the dissemination of public health knowledge throughout the Republic.

5. Several deaths simulating those of a serious epidemic disease, not unlike Pneumonic Plague, were reported from our territory bordering on Korea, including the districts of Fu Sung (撫松), Lin Chiang (臨江) and Chi An (輯安). Chinese medical officers were at once sent to investigate, and the Ministry of the Interior was in constant touch with us regarding the progress of the disease. Considerable anxiety was shown by our Government and by the Russian and Japanese authorities, but we were able to report that the epidemic was one of Typhus, and this was confirmed by Japanese medical men dispatched to the spot by the Chosen Government.

These and other outbreaks reported now and then from various parts of the country emphasise the need of taking every precaution during the most unexpected of times, and justifies the existence of our hospitals not only as units of a comprehensive scheme for the prevention of plague but also as bureaux of information on this and similar epidemic diseases. In this connection I may state that our medical officers and staff are trained to meet all contingencies, and our hospitals, especially that at Harbin, are well equipped for the proper study and control of such diseases.

6. I left Harbin on July 5th for my annual summer trip of inspection to the hospitals at Sansing, Lahasusu and Taheiho. I found that the medical officers had all done their work satisfactorily, and considerable improvements had been made as a result of three years' experience. In my last Report, I had occasion to mention that the natives of the soil, mostly Manchus, are completely ignorant of the elements of hygiene, and numbers are consequently carried away every year by small-pox, tuberculosis and other infectious diseases This time, I found that although much colossal ignorance still exists, the people are more willing to listen to talks on simple home hygiene. At the small village of Lahasusu, our Medical Officer informed me that this spring

over a hundred Fishskin Tartars (the aborigines of that region) brought their children to receive free vaccination at his hands.

The completion of the new Isolation Block at Taheiho Hospital this summer adds considerably to the accomodation for patients there. Owing to the frequent occurrence of serious eye-diseases, to which I drew attention in last year's Report, I have stationed two male medical officers at Taheiho, the duty of one being to look carefully into this important question. Dr. C. M. Luk was sent to the gold mines at Huma, situated two day's journey up the River, to inquire minutely into the causes of this terrible mishap to so many of our strong and otherwise healthy Shantung coolies, and to find means by which it may effectually be put a stop to. His report has not yet reached me, but I have no doubt that once our local authorities and mine-owners co-operate with our staff, not only will hundreds of useful lives be preserved annually, but also a huge economical loss may be averted.

The Women's Medical Department at Taheiho under the care of Mrs. Ung Sung Ung, who succeeded Mrs. Yeh in July, continues to make steady progress. This Department is supported entirely by funds contributed by the local police authorities, who have given us every facility in the prosecution of our work.

7. At our main hospital in Harbin, excellent work has been done during the past year. Although the wards in our Plague Compound are empty, they are ready at all times for the reception of cases. Those allotted for general hospital cases have been much used, especially for the treatment of surgical cases. Operations are performed almost daily, including major ones on the head and abdomen, for cancer and other malignant growths, plating of bones and plastic operations. Cases of small-pox, typhus, erysipelas and other suspicious cases of epidemic disease have been admitted into our isolation blocks, and ours has in fact served as the principal isolation hospital for the reception of infections diseases in this large city.

We have fitted up a museum, in which are displayed plague specimens, all possible apparatus for dealing with an outbreak of plague, models of the principal sanitary appliance recommended for use in this country, pathological specimens which passed through the hands of our medical officers, mosquitoes, fleas, flies and other insects associated with disease in the north, and other interesting objects. At our laboratory we have all facilities for carrying on detailed bacteriological investigations.

8. The present war in Europe has affected us in many directions. Owing to the extraordinary fall in the price of the rouble, which now averages 140 per £10 (the value in normal times is 96 per £10), we have had to pay a high exchange rate for our drugs, instruments and other hospital requisites. The price of firewood has increased half as much again since last year, and labour is unusually dear. In consequence we have had to economise in every way possible, and our medical officers have been warned to be very careful in the use of all things. We have also had to postpone the building of a new block containing the bacteriological laboratory, operation rooms and quarters for resident medical officers, the present ones being too cold in winter.

Dr. F. E. Reynolds, our bacteriologist, resigned from the Service on December 12th to join the British forces in Europe, and steps have been taken to find a well-qualified successor from America.

9. In the research department we have not been inactive The absence of plague in these regions has not allowed us the full opportunity, but our experiments on animals have been continued. The mystery of the fatal disease reported from the upper Sungari regions, which annually kills hundreds of cattle and horses, and often man, through the bite of a large fly, has been cleared up recently. This matter may be briefly mentioned here. Last June, a severe outbreak of epidemic disease among horses and cattle was reported from the Manchuria Agricultural Development Company's farm in the Fu Chin Prefecture (富錦), and three of the coolies employed there also died of it. A fourth man showing signs of the disease was at once sent by steamer to us in Harbin, but he died the night before arrival. His body was removed to our mortuary and a *postmortem* examination made. From microscopical examinations, cultural growths and inoculation experiments upon animals, we came to the conclusion that the disease was Anthrax (known popularly in Russia as Siberian Pest), and that the part played by the large horse fly was purely a mechanical one. In other words, the mode of infection from animal to man is *direct*. as opposed to *indirect* in the case of malaria. I have instructed Dr. Hershberger, the Veterinary Surgeon, to visit Fu Chin at the and of summer and make further ob·ervations on the habits of this fly.

Dr. J. W. H. Chun has been making a study of the worms present in the intestines of the inhabitants of this region, and his

observations, when completed, will prove to be of interest in comparison with information gathered elsewhere on this subject.

Our medical officers at the several stations have also assisted me in the collection of all insects and worms, which are in any way connected with the spread of disease in man and animals. Already we have amassed a considerable group. including several new species, which when classified and confirmed will add much to the knowledge of this branch of Parasitology.

10. We have now sufficient material for the publication of our second scientific report in book form, and it is hoped that this will before long be put in the hands of the printers.

The number of out-patients treated at the different hospitals during the past year may be summarised as follows:—

Harbin	15,395
Sansing	1,684
Taheiho	7,231
Lahasusu	1,338

The above figures do not include Customs, private patients and those of other nationalities treated by us. I am glad to say that at stations like Sansing and Lahasusu, where our hospitals offer the only facilities for medical treatment, the Russian military authorities, merchants and those engaged in the steamer traffic have asked for our medical services, to which they are always welcome.

In Harbin Hospital alone, 408 in-patients were admitted, most of whom required surgical operations of one kind or another under anesthetics. Many more patients could have been treated, but owing to the need of husbanding our resources for other purposes we have limited the number admitted at any one time to 45, and these are required to pay 20 kopeks daily for the food provided them.

11. In the published Report of the China Medical Commission of the Rockefeller Foundation, issued as a result of several months' investigation into the state of medical affairs in China, I am glad to note the acknowledgment that the North Manchurian Plague Prevention Service is the first serious attempt made by the Chinese Government for the placing of the national public health service on a sound scientific basis under capable medical officers. I venture to add that if this pioneer work of ours be allowed to

extend its usefulness further south, we shall be able to produce still more striking results in the saving of lives and an improved change in the hygienic and sanitary comditions of the people.

12. Acting on our advice, the Police Department in the Chinese portion of Harbin has been issuing regular returns of births and deaths, and has notified us of any suspicious cases of infectious disease. We have continued to issue and distribute tracts on the commoner ailments, syphilis, gonorrhoeal ophthalmia and other contagious diseases, and in conjunction with the Council on Public Health of the China Medical Association have printed information relating to Public Health in various Chinese journals. Lectures are frequently given by our staff for the benefit of the masses. Experience has proved that it is only by continually drawing attention to the advantages of a hygienic life among all classes of the community, especially women and children, by means of books, models, printed tracts, public lectures, accurate treatment in our hospitals, etc., that our conservative nation can be made to realise more quickly the aims and objects of modern preventive medicine. Prevention or control of a terrible disease like Plague resolves itself largely into one of prevention or control of other epidemic diseases affecting mankind, in which education of the masses plays a most important part. Provided the majority unders and approximately the cause of Plague and its methods of transmission either by the rat flea or directly from person to person, they can take good care of themselves by observing simple rules. The specially trained medical officer may, in that case, devote more of his time to accurate clinical and scientific observations, leaving the routine work of inspection, disinfection, etc., to a body of sanitary inspectors. It is because I hold this view, which the experience of medical colleagues in other lands has confirmed, that I have urged our colleges in China to give a more thorough training in Public Health (practical as well as theoretical) to their students, and instructed our medical officers to go among the people and act, so to say, as teachers in the practice of hygiene.

13. Since the establishment of the Service in 1912, I have kept in mind the possible outbreak of plague at any time, and our wards and disinfection rooms are always ready for the effective control of such an epidemic. Whilst no cas· has been reported, our medical officers have devoted their time to the alleviation of the sick and suffering in their neighbourhood and used part of their hospitals for the reception and treatment of general cases.

The beneficent influence which such work has exercised among the people is already widespread, and the confidence thus inspired among officials and public alike will render the enforcement of any future measures for the suppression of an epidemic easier than it was some years ago.

Moreover, we have been able to accomplish this at an unusually low cost to the Government, and the Service has in consequence saved a considerable sum during the last few years for possible emergencies. Plague is still endemic in the Kirghiz Steppes and some parts of Siberia, and our efforts should in no way be slackened if we are to avoid the experience of a re-visitation of the scourge of 1910-11. The effective control of an epidemic from the very beginning is of the utmost importance to all concerned, and a reserve fund upon which the Service can rely for carrying this out without further appeal to the Central Government will prove invaluable.

14. The following comprise the principal *personnel* of the Service during the past year:—

Dr. Wu Lien Teh, M.A., M.D., B.C. (Cantab)—Director and Chief Medical Officer.
Mr. R. de Luca (Commissioner of Customs)—Lay Director and Treasurer; left on furlough, April 15th.
Mr. Pierre Grevedon (Commissioner of Customs)—Lay Director and Treasurer; from April 16th.
Dt. Ch'en Sze Pang, M.B., B.C. (Cantab)—Senior Medical Officer, Harbin, up to June 18th, when he left to accept the post of Medical Officer to the Isolation Hospital, Peking.
Mr. F. E. Reynolds, M. B., Ch. B. (Edin)—Bacteriologist; resigned on December 12th to join the British forces in Europe.
Dr. J. Winghon Chun, M.B., B.C., M.R.C.S., L.R.C.P.; joined the Service on January 8th, appointed Senior Medical Officer, Harbin June 18th.
Mr. Luk Chun Hsuan (graduate of Peiyang Medical College)—Senior Assistant Medical Officer, Taheiho.
Dr. Tang Tsung Nien (graduate of Peiyang Medical College)—Asst. Medical Officer, Harbin.
Mr. Lin Chia Suei (graduate of Army Medical College)—Asst. Medical Officer, Lahasusu.
Dr. Ling Ting Fan (graduate of Union Medical College, Peking)—Asst. Medical Officer, Sansing.
Dr. Hu Shih Liang (graduate of Peiyang Medical College)—Asst. Medical Officer, Taheiho.
Mrs. Ung Sung Ung (graduate of Women's Medical College, Foochow)—Female Medical Officer to the Women's Department, Taheiho
Dr. Shih Chi Liang (graduate of Union Medical College. Peking)—Joined September 16th—Asst. Medical Officer, Harbin.
Mrs. Tsao Feng Hui Ch'ing—Matron, Harbin Hospital.
Mr. Huang Kuo Liang, Principal Dispenser.

Dr. Frank Hershberger, D.V.M., graduate of the Kansas City College of Veterinary Medicine, appointed Veterinary Surgeon to the Heilungkiang Government, is affiliated to the Service, and his salary and the expenses incurred in the prosecution of his work are contributed directly by that Government.

Profiting by the Regulations for Medical Officers which were promulgated last year to enable our doctors to take up post-graduate study abroad, Dr. C. H. Luk will soon obtain leave to undergo a full course of training at the Calcutta School of Tropical Medicine, where I have made arrangements with Sir Leonard Rogers, the Dean. Dr. Luk has been engaged in plague prevention work for the last five years, and his six months' leave will enable him to better qualify himself for useful service in the future.

15. I cannot close this Report without expressing my deep appreciation of the interest and sympathy shown by the Governor of Heilungkiang and the Taoyin of Aigun in the successful prosecution of our work. The appointment of a qualified Veterinary Surgeon to co-operate with me in dealing with pests affecting animals will be of far-reaching importance, because of the close relationship between man and the lower animals in the spread of centain epidemic diseases, such as, Plague, Anthrax. Trypanosomiasis (Sleeping Sickness), etc.

I have already referred to the kindness rendered to me on many occasions by my colleagues on the Chinese Eastern Railway. To my Japanese colleagues of the South Manchurian Railway, Dr. A. Stanley (Health Officer of Shanghai) and the Medical Staff of the Bureau of Science, Manila, I wish to express my thanks for their cordial help whenever asked for.

As in past years, I am grateful to the Chinese Government Railways and the South Manchurian Railway for their courtesy in allowing me free passes to travel on their lines.

I am indebted also to the Customs Officers at the various stations in Manchuria for frequent assistance rendered to members of our Service.

Finally, I desire to acknowledge the loyal co-operation of the several members of my medical and lay staff, to whose skill and devotion to duty the present reputation of the Service as an efficiently managed Chinese Government institution is mainly due.

I have the honour to be, etc.,

(*Sgd.*) Wu Lien Teh.
Director and Chief Medical Officer.

SUMMARY OF FOURTH ANNUAL GENERAL REPORT.

Harbin, 20th September, 1916.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a brief summary of the Fourth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September, 1916.

2.—I left Harbin on 4th November, 1915 on six months' leave and returned to duty on 5th May this year. Dr. J. W. H. Chun was acting Director and Chief Medical Officer during this period.

3.—Mr. F. Eberson M.A., M.S., Ph.D., graduate of Columbia University, arrived in Harbin on May 5th. and took up his duties as Bacteriologist of the Service. Previous to this, he had been assistant to Professor Hans Zinsser in New York, and he was in addition recommend to me by Dr. Simon Flexner of the Rockefeller Institute. The laboratory at Harbin has been fitted with a first class electric centrifuge and other up-to-date appliances in order that Mr. Eberson may carry out his work in the most efficient manner. We have for some time been engaged on the problem of immunity in plague, which promises to bring forth some striking results in view of the wide difference which appears to exist between the poisons obtained from this and other well-known disease-producing organisms. The difficulty of procuring animals for experiments in Harbin has been great and has necessarily handicapped our work.

4.—Dr. C. H. Luk (陸存煊) who had been working with me in Manchuria for the last five years, obtained leave last November to take a course in Tropical Medicine at Calcutta under Professor Sir Leonard Rogers. On his return in May, however, the value of the rouble had fallen to 58 Mexican cents (the usual value is $1.15) and he pressed me to allow him to resign from the Service, as it was impossible to support his family with his present salary of

Rs. 200.00 per month. It was in consequence of this and previous applications from other members of the staff, who found it exceedingly hard to meet the unprecedented rise in the cost of living, that I asked for and obtained from the Board a 25 per cent increase on all salaries, to commence on May 1st, of the present year.

Dr. Y. F. Gee (Chu Yuk Fen 朱毓芬) graduate of Peiyang Medical College, who had done two years' post-graduate work in Ophthalmology at Bordeaux University, joined the Service on the 10th August. He has been sent to Taheiho to enquire into and relieve the large number of eye complaints in that region. In this connection I may mention that during my recent visit to the Amur regions I again impressed upon the local authorities the urgent need of making provision for the prevention of the terrible cases of eye disease and blindness so commonly met with in the gold mines. I am hopeful that the necessary steps will be taken next year.

5.—As a result of the repeated requests of the American Agricultural Development Farm at Fuchin on the Sungari river, I instructed Dr. Hershberger, the Veterinary Surgeon of Heilungkiang Province, to proceed thither this spring and make a study of the type of infectious disease, which breaks out regularly among horses and cattle and frequently man. Dr. Hershberger has since submitted a report confirming my observations of last year regarding the existence of Anthrax in an endemic form among the farm animals and is convinced that the microbes are conveyed from animal to animal and sometimes to man by the large horse-fly, which exists in enormous numbers throughout the spring and summer. He was able to prevent much distress and loss by vaccinating and immunising both animals and man with serum, which had been kindly presented for the purpose by the Russian authorities of Blagovestchensk. I trust that this is but the beginning of a systematic attempt to win the confidence of the local farmers by showing them the ease with which a scourge like Anthrax can be prevented and eventually eradicated.

6.—I started from Harbin on 25th May for my annual visit of inspection to the out-station hospitals on the Sungari and Amur. I reached Taheiho on 1st June and found that much progress had been made in the improvement of the hospital since my last visit. The Women's Department particularly shows much progress. We have now two Medical Officers and one Deputy

Female Assistant Medical Officer stationed there, besides Dr. Y. F. Gee who was recently sent to make a serious attempt to cope with the large number of eye diseases in those parts. I found the present Taoyin Mr. Wang Tu (王杜) as anxious as his predecessor to give every assistance to our work.

The Hospital at Lahasusu has been in charge of Senior Dresser Wu Hsi San (武錫三) during the past year. I found that he had carried out his duties most satisfactorily. I stayed at Sansing for two days (June 19th-20th), and sanctioned some necessary repairs. At all these stations there has been a marked change for the better in the people's ideas about modern preventive medicine. I returned to Harbin on 22nd June.

7.—The first annual conference of the National Medical Association, of which I was Secretary last year and am now President, took place in Shanghai on 7-12 February. As in the case of the Missionary Medical Conference held the year before, the members of our Service took a prominent part by sending papers and displaying a large number of exhibits connected with plague and other kinds of infectious disease and their method of prevention. The next Conference will be a joint one consisting of the Missionary Medical Association and the National Medical Association, and will be held in Canton about the time of the old Chinese New Year. I am pleased to note the increasing interest which officials and people of this land are watching the progress of our work and our attempts to instil a public health conscience into their minds, without which modern scientific medicine can make little headway. In this regard I may mention the enthusiasm with which the scheme of a Central Model Hospital in Peking, now in course of construction, has been received by all classes, and the success which has already attended the establishment of the Peking Isolation Hospital for the reception and treatment of cases of infectious diseases.

8.—The past year has been a quiet one for plague, which even in India and Hongkong appears to have subsided considerably. Manchuria and North China have remained entirely free from the pest, and this makes the sixth consecutive year in which the disease has not occurred throughout the Northern Provinces.

The continued existence of Cholera in Japan, especially Nagasaki and southern parts, has put us seriously on our guard, but I am confident that the well organised Sanitary Service of that country will be able to cope successfully with any contingency that may arise.

The serious epidemic of Acute Poliomyelitis (Infantile Paralysis) which, beginning with the city of New York, has been spreading throughout the Eastern States of America, has claimed the attention of the world. Already over seven thousand cases have been reported since June with 25 per cent of deaths. This disease is peculiar in that the microorganism causing the disease has not been definitely isolated nor has the proper means for its prevention or treatment been found. The best physicians and scientists of America, however, are now at work on the problem, and it is hoped that before long this difficulty may be cleared up, and the epidemic stamped out.

9.—The number of out-patients treated at the different hospitals may be summarised as follows, as compared with those of preceding years:—

	1916.	1915.	1914.
Harbin	19,395	19,167	14,687
Sansing	3,893	3,684	4,149
Taheiho	7,178	7,231	7,548
Lahasusu	1,221	1,338	1,830

The above do not include in-patients treated, of whom Harbin alone has 538 this year.

It may be mentioned that owing to the lack of sufficient funds for general hospital work only a limited number of applications, mostly surgical, are admitted. All these pay for their maintenance.

The Senior Medical Officer at Harbin reports that patients come from all parts to be treated—some as far as 2,500 *li* away. Cases of infectious disease admitted include Typhus, Scarlatina, Erysipelas, Small-pox, Chicken-pox, Parotitis, and Whooping Cough. Profiting by the increased knowledge obtained in the treatment of septic wounds during the present war, our Medical Officers have successfully tried new forms of treatment for these conditions.

10.—In the research department, Mr. Eberson and I have lately carried out a series of successful investigations on the transmission of Pulmonary and Septicemic Plague among marmots. Our results obtained so far are embodied in a paper which will be published simultaneously in England and America. A copy with illustrations is herewith enclosed in the form of an appendix to this Report. The discovery that marmots, like human beings,

are able to transmit plague themselves by coughing, *i.e.* through the respiratory tract, raises a question of the utmost importance, in that other susceptible domestic animals like the rat, mouse, cat, etc., may do the same. We have also been able to establish the fact, hitherto denied by many workers, that marmots can take plague by feeding upon infected organs. Our experiments regarding plague transmission through the agency of ticks have been limited in number owing to the scarcity of animals, but we have evidence to prove that as far as the marmot is concerned, the tick, which is frequently the only parasite infesting its skin, is as capable as the flea in conveying the disease from animal to animal. The above discoveries open up a wide field for further investigation, and we hope in the course of another year to complete the work we have in hand regarding the possibility of applying to plague victims a more potent serum than any at present available.

11.—The following comprise the principal personnel of the Service during the past year:—

Dr. Wu Lien Teh M.A., M.D., B.C. (Cantab) Director & C.M.O.

Mr. Pierre Grevedon (Commissioner of Customs) Lay Direrton and Treasurer.

Dr. Chun Wing Hon M.B., B.C. (Cantab), M.R.C.S. (England) L.R.C.P. (London), Senior Medical Officer, Harbin.

Mr. Frederick Eberson M.A., Ph. D. (Columbia), M.S. (Iowa) Bacteriologist to the Service.

Dr. Luk Chun Hsuen (Graduate of Peiyang Medical College)—Senior Assistant Medical Officer, Taheiho, resigned May 1st, 1916.

Dr. Tang Tsung Nien (Graduate of Peiyang Medical College)—Assistant Medical Officer, Sansing.

Dr. Y. F. Gee (Chu Yuk Fen) (Graduate of Peiyang Medical College and postgraduate interne in ophthalmology, Bordeaux) Special Surgeon to Eye Department, Taheiho.

Dr. Lin Chia Swee (Graduate of Army Medical College, Tientsin)—Assistant Medical Officer, Taheiho.

Dr. Shih Chi Liang (Graduate of Union Medical College, Peking—Assistant Medical Officer, Harbin.

Dr. Hu Shih Liang (Graduate of Peiyang Medical College)—Assistant Medical Officer, Taheiho.

Mrs Chen Chin Tsai Deputy Female Assistant Medical Officer, Taheiho.

Mrs. Ung Sung Ung, Sister in-charge, Harbin Hospital.

Mrs. Tsao Feng Hui Ching, Matron Harbin Hospital.

Mr. Wu Hsi San, Dresser-in-charge, Lahasusu Hospital.

12.—In conclusion I may record the great advance in municipal undertakings which has been noticed in the Chinese and Russian parts of Harbin during the past year. In spite of the war and increased cost of living, wealth has increased by leaps and bounds among the mercantile classes, and the Chinese city of Fuchiatien can scarcely be recognised owing to the large number of fine brick buildings which have taken the place of the mud

or wooden huts of plague times. The extensive area of land lying between the settlement bridge and the entrance to the Chinese city has been reclaimed and sold in building lots, mainly to Chinese business men. In this way millions of roubles have been realised for municipal improvements, such as the laying of fine macadamised streets, construction of open drains and improvement of street lighting. The Chinese city is also to the fore, and two steam rollers (one of Belgian and the other of Japanese manufacture) have been bought for laying out proper macadamised roads in place of the irregular loose earth which has up to now been the principal feature of the thoroughfares. One of the new roads in contemplation leads direct to our hospital. A new ara of prosperity has undoubtedly set in, and it is earnestly hoped that our public health work may go hand in hand with it.

I cannot close this Report without expressing my appreciation of the continued co-operation of the principal officials of the different localities, with whom I have come in contact.

To my medical colleagues on the Chinese Eastern and the South Manchurain Railways, I wish again to express my thanks for their cordial help whenever asked for. To Dr. Christie and the staff of his Medical College at Mukden I am indebted for facilities given me and Mr. Eberson during our recent plague investigation.

As in former years. I am grateful to the Chinese Government and the South Manchurian Railways for their courtesy in providing me with free passes to travel on their lines.

I am also indebted to the Customs officers at the various stations in Manchuria for frequent assistance rendered to members of our Service.

Finally, I desire to acknowledge the loyal co-operation of the several members of our medical and lay staff, to whose skill and devotion to duty the present reputation of the Service as an efficiently managed Chinese Government institution is mainly due. I am confident that given greater opportunities, we shall be able to extend to other parts of China the same beneficent work which we have been privileged to carry out in Manchuria during the past five years.

I have the honour to be, etc.,

(*Sgd.*) WU LIEN TEH.

SUMMARY OF FIFTH ANNUAL GENERAL REPORT.

Harbin, 26th October, 1917.

To His Excellency,
The Minister for Foreign affairs,
Peking.

Sir,

I have the honour to submit a brief summary of the Fifth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September, 1917.

2. I beg to thank you for your communication announcing the approval of the Diplomatic Body to the placing of our yearly appropriation upon a permanent basis. This welcome decision will, I am sure, enhance the future success of our work, for a feeling of security will hereafter exist among all ranks of the Service and thus promote the best interests of public health in Manchuria and other parts of China.

3. Owing to the extraordinary depreciation of the rouble, upon which our appropriation has hitherto been fixed, and the increased cost of material and living, the members of our Service have gone through a very anxious period indeed. Our budget was arranged when the rouble was worth $1.20 Mex., but since the commencement of the war the value of the former has steadily gone down, until at the present time one rouble stands at 14 cents Mex. only. The suffering thus entailed, especially upon the lower employes, has been immense, and it speaks volumes for their loyalty and earnestness in that they have stuck to their posts for almost a year in face of so much discouragement. The happy news that the original appropriation of Tls. 60,000 will be resorted to instead of Rs. 78,000 will be received with much relief by all.

4. Last December, I asked for and obtained leave to proceed to Hongkong and accept the Honorary Degree of LL.D. which the Governor of the Colony, officiating as Chancellor of the University, wished to confer upon me "as some recognition of the prominent part you have played in medical administration and research in China." There were altogether five recipients, and I was honored by being the only medical man to obtain the distinction.

5. I also availed myself of that opportunity to attend the Joint Conference of the China Medical Missionary Association and the National Medical Association which was held in Canton from Jan. 24 to 30, 1917. Together with Dr. Venable I sat alternately as President of the Joint Conference and was re-elected for a further period of two years. As in the former years, the members of our Service took a prominent part in reading papers and sending exhibits. The paper by Dr. F. Eberson, our Bacteriologist, on "The Nature of Plague Proteotoxins" aroused considerable interest because it anticipated the discovery of a new successful serum against Pneumonic and Septicemic plague, upon which we have concentrated our attention during the last few years. Full details of this later work have been published recently in the American Journal of Experimental Medicine. This serum, if proved effective in practice, will indeed mark a step forward in the treatment of plague cases, especially of the pneumonic and septicemic variety.

6. I received a lengthy communication last March from the Manager of the American Manchuria Development Company thanking the Service for the assistance we rendered them in having diagnosed and prevented Anthrax among men and cattle in their newly-opened farms There is no doubt that if our Government and the local farmers work hand in hand to suppress this Anthrax scourge, the fertile regions of North Manchuria will yield most productive returns in a short time.

7. I have to thank the Board for the joint invitation of the Ministry of Interior and the Wai Chiao Pu to me to assist in the organisation of the Central Hospital and the Institute of Public Health to be established in Peking, and for permission to remain there as long as required for the purpose. The opening of this great Model Hospital in the Capital will mark an epoch in medical science, for the greatest care has been concentrated upon it in order that our countrymen may truly understand and benefit by the marvellous progress which modern medical science has made in recent times.

8. I left Harbin on June 13th for my annual trip of inspection to the out-station hospitals on the Sungari and Amur. I arrived at Sansing on June 17th, Lahasusu on June 20th, and Taheiho on June 25th. Owing to the low state of the water, the journey was exceedingly slow and took 15 days instead of 5½ days to accomplish.

I found all the hospitals well kept, and considerable progress was reported everywhere. A proper carriage drive, paved with cobbles, has now been made leading from the town of Taheiho to the Hospital. The officials, merchants, and gentry there have shown commendable enterprise in helping our medical officers with financial support in constructing and lighting the road.

9. Our Research Department in Harbin has during the past year undertaken bacteriological and chemical examinations for ascertaining the purity of water supplies, mineral waters and milk. On several occasions we have been asked to analyse pills sold in the town. Our medical officers have also acted as examiners for practitioners of medicine in the city ; of nineteen thus examined, only one passed our requirements.

In spite of the war and increased cost of everything, large sums of money have been spent by the authorities upon road construction and other municipal improvements. The Chinese city is now practically a new town built upon modern lines, a large part of the river bank having been reclaimed for wharfs and main business throughfares. The price of land has increased by leaps and bounds. The value of the lot upon which our hospital stands is assessed at no less than half a million roubles.

10. The past year has been a very healthy one so far as infectious disease is concerned. Plague continues to be absent throughout Manchuria and North China making this the seventh successive year in which it has not occurred. An outbreak of Pneumonic Plague was reported by Dr. Robert Parry (an English missionary doctor) from T'aochow in Kansu on the Tibetan border, and was easily suppressed. Small-pox was prevalent for some time in Harbin and the villages on the rivers, but scarlet fever was not so no iceable as in Shanghai, where the disease claimed an unusual number of victims this year. Dysentery and Enteric Fever have not been abno mally high. The disastrous floods which have recently occurred in Tientsin and the surrounding districts may easily lead this winter to a serious epidemic of Typhus, Relapsing Fever and other infectious diseases unless proper sanitary precautions are taken now.

11. Dr. F. Eberson, who has done excellent work during the past year, left for America on 28th June to continue his plague investigations in an American laboratory. He will receive an allowance of one thousand gold dollars from the funds of the Service for the prosecution of this work.

Dr. Frank Hershberger, Veterinary Surgeon of the Heilungkiang Government and affiliated to our Service, left for America in September after three years of useful work in the northern regions. His successful work in preventing the spread of anthrax among cattle and horses in the various farms will not be easily forgotten by those who have benefited by his advice.

Mrs. Tsao, matron of our Hospital in Harbin, who had been connected with the Service since its inauguration, was cruelly murdered by burglars on the evening of May 26th. The chief nurse, Miss Chen, was attacked at the same time, but she fortunately recovered. This is only one instance of an increasing number of acts of violence which have become prevalent since the advent of the Revolution in Russia. I wish to thank the Board for agreeing to my proposal to allow the relatives of Mrs. Tsao the sum of 1,000 roubles as compensation for her faithful services.

12. The number of out-patients treated at the different hospitals are set down in the following table as compared with preceding years :—

	1916	1915	1914	1913
Harbin	10,652	14,587	19,395	19,167
Taheiho	6,847	7,173	7,231	7,548
Sansing	3,740	3,693	3,684	4,139
Lahasusu	1,018	1,221	1,338	1,830

The number of in-patients treated at Harbin Hospital is 452, mostly surgical.

13. The following comprise the principal personnel of the Service during the past year :—

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Mr. P. Grevedon, (Commissioner of Customs), Lay Director and Treasurer.
Dr. Chun Wing Hon, Senior Medical Officer, Harbin.
Dr. F. Eberson, Bacteriologist to the Service, now working on plague problems at Harvard Medical College, Boston, U.S.A.
Dr. Tang Tsung Nien, Resident Medical Officer, Sansing.
Dr. Chu Yuk Fen, Special Surgeon to Eye Dept., Taheiho, left on 31st. May, 1917.
Dr. Lin Chia Swee, Resident Medical Officer, Taheiho.
Dr. Ling Ting Fan, Assistant Medical Officer, Harbin,
Dr. Shih Chi Liang, Assistant Medical Officer, Harbin.
Dr. Hu Shih Liang, Assistant Medical Officer, Taheiho ; resigned Sept. 1917.
Mrs. Chen Chin Tsai, Deputy Female Medical Officer, Taheiho
Miss Chen Chi Ching, Chief Nurse, Harbin Hospital.
Mr. Wu Hsi San, Senior Dresser-in-charge, Lahasusu.

14. I wish to conclude this Report by expressing my appreciation of the valuable services rendered by the lay and medical staff and of their constant loyalty and devotion to duty during a critical period lasting several months when their salaries were insufficient to purchase even the bare necessities of life.

To my colleagues of the Chinese Eastern and South Manchurian Railways, I wish again to tender my thanks for their cordial help when asked for. To the Chinese Government and South Manchurian Railways I am indebted for their courtesy in providing me with free passes to travel on their lines. Through the kindness of the Ministry of Navy, Dr. Eberson and I were enabled to spend some profitable months pursuing plague investigations in the Naval Medical College of Tientsin. Lastly, I wish as in former years to express my appreciation of the assistance rendered by officers of the Customs at the stations where we have established Hospitals.

I have, etc., etc.,

(*Sgd*) WU LIEN TEH.

Director and Chief Medical Officer.

PETITION TO THE WAI CHIAO PU FOR A PERMANENT GRANT TO THE SERVICE.

Harbin, 11th November, 1916.

TO HIS EXCELLENCY,
THE MINISTER FOR FOREIGN AFFAIRS,
PEKING.

SIR,

I have the honour to submit a petition for the placing of the North Manchurian Plague Prevention Service upon a permanent footing in order that its organisation may be made more effective than it has been in the past.

2. It may be remembered that this Service was established in October, 1912, as a result of the recommendation of medical experts from eleven countries who attended the International Plague Conference held in Mukden in April 1911.

3. With the approval of the Diplomatic Body, the sum of seventy-eight thousand roubles was appropriated from the Customs Revenue for the maintenance of the Service, the stipulation being that this appropriation would have to be applied for annually.

4. Since the establishment of the Service nearly five years have elapsed. We have submitted regular quarterly and other reports to the Government and have not only carried on our work systematically and effectively, but have published important data in scient fic journals in China, Europe and America dealing with researches on various aspects of plague and allied diseases. The Rockefeller Foundation, which sent out a Medical Commission to China a year and a half ago, alluded to the North Manchurian Plague Prevention Service as the only properly organised attempt on the part of our Government to institute a Public Health Service in the country.

5. In order to enable our work to be done still more effectively, it is necessary for the members of the medical staff to have a feeling of security should their services prove satisfactory, to

allow the administration sufficient time to look ahead in the management of affairs, and to save the waste accruing from short term contracts with medical officers.

6. I shall therefore be grateful if you will request the Diplomatic Body to delegate some medical men to inspect our work at the different centres and satisfy themselves as to its efficiency. Should their report coincide with our expections, we shall be glad if the formality of an annual application for funds may be dispensed with, and our Service permitted to receive its grant automatically.

7. I shall always welcome any ideas or plans by which the usefulness of our work in Manchuria may be enhanced and extended to other regions, so as to enable other branches of Public Health work besides the prevention of Plague to be instilled into the minds of the people.

I have the honour to be, etc.,

(*Sgd.*) WU LIEN TEH.

PETITION TO THE WAI CHIAO PU FOR GRANT OF TLS. 60,000 INSTEAD OF RS. 78,000.

Harbin, 17th September, 1917.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to draw your attention to the serious position in which the various members of our Service have been placed on account of the unprecedented fall of the rouble.

2. You may remember that when our Service was first established in 1912, it was estimated that the yearly expenditure as made out by the then Commissioner of Customs and myself would come to Tls. 60,000, but that owing to the fluctuation of silver, it was considered best to fix the appropriation at Rs. 78,000 (counting the Tael as Rs. 1.30.) At this rate of exchange we have continued our work for the last five years.

3. Since the outbreak of the present war in 1914, however the rouble has steadily depreciated in value, and though all the members of our staff have suffered in greater or less degree, they have wai ed patiently for a return to better times. Lately, the rouble has fallen to 14 Mex. cents (the n minal pre-war rate is Mex. $1.`0), and has produced widespread consternation. I have received numerous letters from the staff that unless immediate steps be taken to relieve the situation, they will resign.

4. I have therefore no alternative but to appeal to you to request the Diplomatic Body to agree to the fixing of our appropriation in Taels instead of Roubles, otherwise the work which we have built up during the last five years will collapse.

I have the honour to be, etc.,

(*Sgd*) Wu Lien Teh.

REPLY OF THE WAI CHIAO PU TO PETITIONS.

(*Translation from Chinese.*)

Peking, October 20th, 1917.

THE DIRECTOR,
NORTH MANCHURIAN PLAGUE PREVENTION SERVICE,
HARBIN.

SIR,

I have the honour to acknowledge the receipt of your petitions asking for a permanent grant for the maintenance of the Plague Prevention Service, and also for the change of the grant of Rs. 78,000 into Tls. 60 000 owing to the unprecedented fall of the rouble from Mex. $1.20 to 14 cents.

2. In reply, I have to state that a dispatch has been received from the Dean of the Diplomatic Body to the effect that they consent to a permanent appropriation of Rs. 78,000 to be drawn annually from the Customs in Harbin, on the understanding that this consent does not prejudice the right of the Diplomatice Body to terminate the appropriation should circumstances demand it.

3. In regard to the change from Rs. 78,000 to Tls. 60,000, the Diplomatic Body understands the critical state of affairs and agrees to this change during the current year, leaving the decision of future years to a subsequent occasion.

I have, etc.,

(*Sgd.*) WANG TA HSIEH,
Minister of the Wai Chiao Pu.

Summary of Patients Treated During the Years 1913—1917, Harbin Hospital.

	1913[1]	1914	1915	1916	1917[2]	TOTAL
I. SPECIFIC INFECTIOUS DISEASES	...	...	...	...	...	...
a. Bacterial Diseases	...	...	...	...	...	...
1. Typhoid fever	...	1	6	8	...	15
2. Erysipelas...	...	6	1	3	...	10
3. Diphtheria	...	...	...	...	...	...
4. Pneumonia	1	27	4	...	...	32
5. Influenza	...	2	1	...	...	3
6. Whooping cough	...	...	...	2	...	2
7. Gonococcus Infections	51	203	273	149	17	693
8. Dysentery...	11	8	36	116	4	175
9. Cholera	...	...	...	...	...	...
10. Plague	...	...	...	...	...	...
11. Tetanus	...	...	...	...	...	...
12. Leprosy	...	...	2	3	...	5
13. Tuberculosis	105	360	337	176	7	985
b. Non-bacterial Fungus Infections	8	27	8	...	...	43
c. Protozoan Infections	...	...	...	...	...	...
1. Malaria	2	27	4	7	...	40
2. Relapsing fever	...	...	1	...	...	1
3. Syphilis	255	1273	1399	1334	80	4341
d. Metazoan Diseases	...	...	...	...	...	...
1. Intestinal Cestodes, Tapeworms	...	8	1	3	...	12
2. Diseases caused by Nematodes	30	36	66	9	...	141
3. Parasitic Insects	44	143	73	...	..	260
e. Infectious Diseases of Unknown Etiology	...	...	...	...	...	...
1. Small Pox...	...	1	...	1	...	2
2. Chicken Pox	...	...	...	...	...	...
3. Measles	...	1	...	...	...	1
4. Scarlet fever	...	3	...	...	...	3
5. Epidemic Parotitis	...	10	12	24	...	46

10. Acute Catarrhal fever	5	43	7	41	4	100	
II. INTOXICATIONS	...	...	3	...	...	3	
a. Alcoholism	...	6	...	...	...	6	
b. Morphia Habit	2	2	...	...	...	4	
c. Lead-poisoning	...	...	...	...	...	...	
d. Arsenical	...	...	...	...	...	...	
e. Food poisoning	...	...	...	...	...	...	
f. Beri-beri	...	1	...	...	...	1	
III. DISEASES OF METABOLISM	...	...	...	...	...	...	
a. Rheumatism	...	...	...	...	...	...	
b. Diabetes	1	12	5	3	...	21	
c. Rickets	...	...	...	...	...	...	
d. Scurvy	...	...	...	...	...	...	
IV. DISEASES OF THE DIGESTIVE SYSTEM	246	1897	953	902	81	4079	
V. „ „ „ RESPIRATORY SYSTEM	232	810	580	466	64	2152	
VI. „ „ „ GENITO-URINARY SYSTEM	52	429	159	96	3	739	
VII. „ „ „ BLOOD	39	75	29	23	6	172	
VIII. „ „ „ CIRCULATORY SYSTEM	86	188	194	29	24	521	
IX. „ „ „ DUCTLESS GLANDS	...	8	10	70	22	110	
X. „ „ „ NERVOUS SYSTEM	62	181	211	122	6	582	
XI. „ „ „ LOCOMOTOR SYSTEM	113	481	338	424	11	1370	
XII. „ „ „ EYE	140	1154	1332	817	38	3481	
XIII. „ „ „ SKIN	70	375	444	497	34	1420	
XIV. „ „ „ NOSE, THROAT, AND EAR	24	261	169	97	33	584	
XV. „ „ „ WOMEN	10	38	93	110	46	297	
XVI. SURGICAL CASES	1692	9506	8765	5573	419	25955	
XVII. VACCINATIONS[3]	...	82	90	394	...	566	
XVIII MIDWIFERY[4]	...	...	...	2	...	2	
TOTAL	3289	17954	15626	11549	906	49324	

1. Comprises only 4 months.
2. Comprises only first three months.
3. Excludes a large number seen outside.
4. Does not include cases seen outside.

Summary of Patients Treated During the Years 1913-1917, Taheiho Hospital.

	1913[1]	1914	1915	1916	1917[2]	TOTAL.
I. SPECIFIC INFECTIOUS DISEASES	...	...	...	...	...	...
a. Bacterial Diseases...	...	...	...	...	...	...
1. Typhoid fever...	...	...	...	14	...	14
2. Erysipelas...	...	3	1	1	...	5
3. Diphtheria	...	...	...	...	...	...
4. Pneumonia	...	3	4	18	7	32
5. Influenza	...	...	1	3	2	6
6. Whooping cough	...	...	...	...	...	...
7. Gonococcus Infections	...	36	31	62	10	139
8. Dysentery	...	17	24	16	...	57
9. Cholera	...	...	...	...	...	...
10. Plague	..	...	...	...	...	...
11. Tetanus	...	...	...	...	...	...
12. Leprosy	...	...	3	1	...	4
13 Tuberculosis	...	36	85	154	14	289
b. Non-bacterial Fungus Infections.	...	...	...	...	...	...
c. Protozoan Infections	...	...	...	...	...	...
1. Malaria	...	7	27	60	1	95
2. Relapsing fever	...	...	...	...	...	...
3. Syphilis	...	131	137	108	19	395
d. Metazoan Diseases.	...	...	...	...	...	...
1. Intestinal Cestodes, Tapeworms	...	2	1	2	...	5
2. Diseases caused by Nematodes	...	2	6	...	...	8
3. Parasitic Insects	...	22	5	...	...	27
e. Infections Diseases of Unkown Etiology	...	...	...	...	...	...
1. Small Pox...	...	...	...	3	...	3
2. Chicken Pox	...	...	1	...	...	1
3. Measles	...	...	...	...	...	...
4. Scarlet fever	...	...	...	...	...	...
5. Epidemic Parotitis	...	...	6	30	3	39
6. Typhus						

10. Acute Catarrhal fever	13	1	2	1	17
II. INTOXICATIONS	...	...	...	...	...
a. Alcoholism	2	2	...	...	4
b. Morphia Habit	...	...	21	...	21
c. Lead-poisoning	...	...	...	...	...
d. Arsenical-poisoning	...	...	1	...	1
e. Food-poisoning	...	...	...	...	...
f. Beri-beri	...	...	...	...	...
III. DISEASES OF METABOLISM.	...	...	...	...	...
a. Rheumatism	...	...	...	...	...
b. Diabetes	2	...	...	...	2
c. Rickets	...	1	...	...	1
d. Scurvy	...	...	...	...	...
IV. DISEASES OF THE DIGESTIVE SYSTEM	137	204	254	35	630
V. " " " RESPIRATORY SYSTEM	43	87	142	44	316
VI. " " " GENITO-URINARY SYSTEM	12	112	180	18	322
VII. " " " BLOOD	...	1	1	1	3
VIII. " " " CIRCULATORY SYSTEM	11	7	4	2	24
IX. " " " DUCTLESS GLANDS	36	11	18	1	66
X. " " " NERVOUS SYSTEM	8	26	43	8	85
XI. " " " LOCOMOTOR SYSTEM	15	17	75	19	126
XII. " " " EYE	181	436	398	...	1015
XIII. " " " SKIN	46	122	108	24	300
XIV. " " " NOSE, THROAT, AND EAR	9	33	72	24	138
XV. " " " WOMEN	...	...	...	...	...
XVI. SURGICAL CASES	291	516	573	161	1541
XVII. VACCINATIONS*	...	2	22	53	77
XVIII. MIDWIFERY*	...	...	2	...	2
TOTAL	1,127	1,977	2,436	450	5,986

1. Hospital not yet built.
2. Comprises only first three months.
* Includes only cases seen or admitted into Hospital.

Summary of Patients Treated During the years 1914-17, Sansing Hospital.

	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	May	April	March	Feb.	Jan.	1914 Total	1915	1916	1917	[1] Total
SPECIFIC INFECTIOUS DISEASES																	
Bacterial Diseases																	
1. Typhoid fever																	
2. Erysipelas						1							1				1
3. Diphtheria																	
4. Pneumonia																	
5. Influenza			1							16	11	4	31				31
6. Whooping Congh													1	6			7
7. Gonococcus Infections	2	7	3	1	3	4	3	9	14	9	8	18	81	99	45	10	235
8. Dysentery				3	2		5	3		2	5		20	5	14	4	43
9. Cholera														1			1
10. Plague																	
11. Tetanus																	
12. Leprosy																	
13. Tuberculosis	3	3	7	13	19	33	21	37	37	17	2	3	195	33	61	5	294
Non-bacterial Fungus Infections																	
Protozoan Infections																	
1. Malaria						1	1						2	3	4		9
2. Relapsing fever																	
3. Syphilis	3	6	4	3	5		17	12	4	3	8		65	191	53	3	312
Metazoan Diseases																	
1. Intestinal Cestodes, Tapeworms																	
2. Diseases caused by Nematodes	2				1	5	1		1	4			14		5		19
3. Parasitic Insects							2	1	1				14		7	1	22
Infectious Diseass of Unknown Etiology													4	1			5
1. Small-pox																	
2. Chicken-pox							1	1					2				2
3. Measles																	
4. Scarlet fever							1						1				1
5. Epidemic Parotitis							1						1				2
6. Typhus							1						1				

9.	Acute Tonsilitis	3	1	...	1	...	1	4	3	...	1	3	17	7	34	7	65
10.	Acute Catarrhal fever	1	2	...	5	3	...	...	...	...	...	...	11	17	21	1	50
I.	INTOXICATIONS	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
a.	Alcoholism	1	...	...	...	...	...	...	1	...	...	...	2	2	...	...	4
b.	Morphia Habit	...	...	...	...	...	...	1	...	...	...	...	1	...	...	1	2
c.	Lead Poisoning	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
d.	Arsenical Poisoning	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
e.	Food Poisoning	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
f.	Beri-beri	3	...	...	...	...	...	1	...	...	...	...	4	1	...	...	5
II.	DISEASES OF METABOLISM...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
a.	Rheumatism	3	13	13	25	32	41	58	57	36	40	9	...	327	6	...	...	333
b.	Diabetes	2	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	2
c.	Rickets	...	...	...	...	...	...	...	...	...	...	1	...	1	...	1	...	2
d.	Scurvy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V.	DISEASES OF THE DIGESTIVE SYSTEM...	20	9	16	45	48	56	48	106	65	49	50	25	537	165	231	26	959
V.	,, ,, ,, RESPIRATORY ,,...	18	7	14	14	15	33	17	56	56	31	15	11	287	139	197	27	650
VI.	,, ,, ,, GENITO-URINARY ,,...	1	2	5	2	14	20	4	3	2	2	1	5	61	22	34	3	120
VII.	,, ,, ,, BLOOD	1	2	3	2	...	1	3	3	2	3	1	...	21	6	61	...	88
VIII.	,, ,, ,, CIRCULATORY ,,...	6	2	5	2	1	4	4	4	9	...	3	...	40	10	51	...	101
IX.	,, ,, ,, DUCTLESS GLANDS ...	1	3	...	4	4	16	6	13	9	7	1	2	66	16	66	...	148
X.	,, ,, ,, NERVOUS SYSTEM ...	2	7	9	20	15	27	28	58	44	20	15	...	245	22	74	8	349
XI.	,, ,, ,, LOCOMOTOR ,, ...	...	...	4	2	5	8	4	6	20	9	2	1	61	1	50	28	140
XII.	,, ,, ,, EYE	11	15	21	26	37	62	71	98	70	15	10	12	448	143	231	39	861
XIII.	,, ,, ,, SKIN	9	12	7	22	30	30	23	32	21	17	35	20	258	124	222	36	640
XIV.	,, ,, ,, NOSE, THROAT & EAR	8	1	7	8	2	10	6	14	3	...	5	6	70	37	51	7	165
XV.	,, ,, WOMEN	5	2	2	2	1	3	6	9	15	10	11	4	70	103	196	5	374
XVI.	SURGICAL CASES	137	133	133	149	172	190	97	309	185	138	54	64	1761	744	1422	225	4152
XVII.	VACCINATIONS	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...
XVIII.	MIDWIFERY	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...
	TOTAL...	237	229	257	343	413	548	428	839	599	392	249	178	4712	1997	3193	436	10332

1. Comprises only first three months.
2. Does not include cases seen outside.
3. ,, ,, ,, ,, ,, ,,

Summary of Patients Treated During the years 1913-1917, Lahasusu Hospital.

	1913[a]	1914[b]	1915	1916	1917[1]	TOTAL.
I. SPECIFIC INFECTIOUS DISEASES....	...	...	...	...	...	...
a. Bacterial Diseases....	...	...	...	...	...	...
1 Typhoid fever	...	...	1	1	...	2
2. Erysipelas	...	...	1	...	...	1
3. Diphtheria	...	...	...	...	...	....
4. Pneumonia...	...	...	12	14	...	26
5. Influenza	...	...	9	23	...	32
6. Whooping couph	...	...	...	2	...	2
7. Gonococcus Infections	...	...	18	17	1	36
8. Dysentery	...	...	14	23	...	37
9. Cholera	...	...	...	2	...	2
10. Plague	...	...	...	...	...	...
11. Tetanus	...	...	...	...	...	...
12. Leprosy	...	...	...	...	...	...
13. Tuberculosis	...	...	21	50	6	77
b. Non bacterial Fungus Infections.	...	...	...	...	...	...
c. Protozoan Infections	...	...	...	...	...	...
1. Malaria	...	...	10	...	...	10
2. Relapsing fever	...	...	...	3	...	3
3. Syphilis	...	...	42	40	3	85
d. Metazoan Diseases...	...	...	...	...	...	...
1. Intestinal Cestodes, Tapeworms.	...	...	...	...	1	1
2. Diseases caused by Nematodes	...	...	...	7	2	9
3. Parasitic Insects	...	...	...	5	...	5
e. Infectious Diseases of Unknown Etiology	...	...	...	...	...	...
1. Small Pox	...	...	...	...	...	...
2. Chicken Pox	...	...	...	...	...	...
3. Measles	...	...	1	...	...	1
4. Scarlet fever	...	...	...	...	...	...
5. Epidemic Parotitis	...	...	...	...	1	1

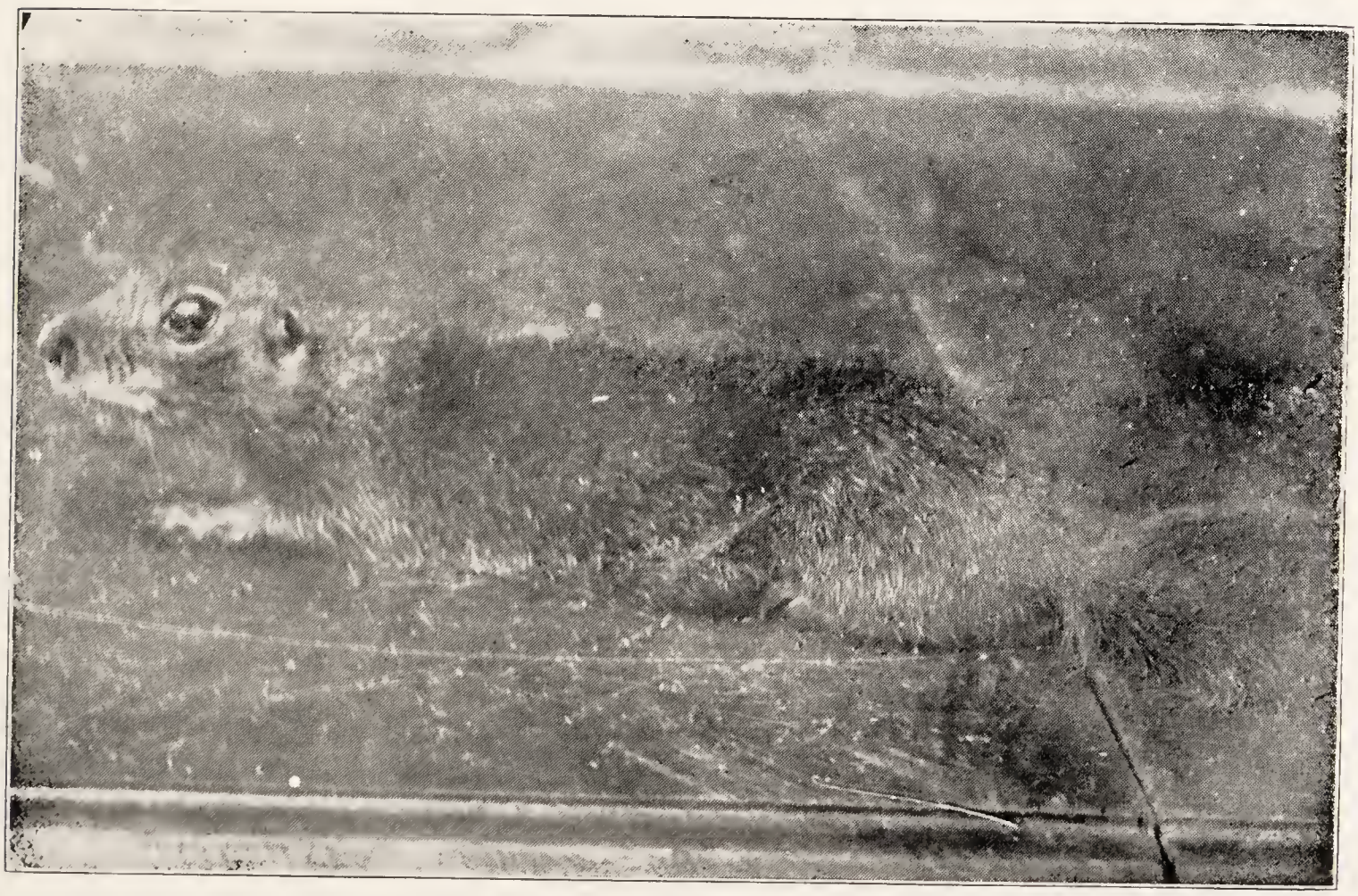
10. Acute Catarrhal fever	1	17	...	18		
II. INTOXICATIONS.						
a. Alcoholism		2	1	3		
b. Morphia Habit		5	1	6		
c. Lead-poisoning		3	...	3		
d Arsenical Poisoning		2	...	2		
e. Food Poisoning		1	...	1		
f. Beri-beri	3	9	...	12		
III. DISEASES OF METABOLISM.						
a. Alcoholism		3	...	3		
b. Diabetes		12	...	12		
c. Rickets		1	...	1		
d. Scurvy	7	5	...	12		
IV. DISEASES OF THE DIGESTIVE SYSTEM.	119	55	8	182		
V. ,, ,, ,, RESPIRATORY SYSTEM	57	34	4	95		
VI. ,, ,, ,, GENITO-URINARY SYSTEM	20	16	7	43		
VII. ,, ,, ,, BLOOD	23	47	11	81		
VIII. ,, ,, ,, CIRCULATORY SYSTEM	12	13	2	27		
IX. ,, ,, ,, DUCTLESS GLANDS	1	21	7	29		
X. ,, ,, ,, NERVOUS SYSTEM	22	28	6	56		
XI. ,, ,, ,, LOCOMOTOR SYSTEM	...		6	10		
XII. ,, ,, ,, EYE	75	66	6	147		
XIII. ,, ,, ,, SKIN	59	52	9	120		
XIV. ,, ,, ,, NOSE THROAT, AND EAR	36	77	2	115		
XV. ,, ,, ,, WOMEN	4	110	10	124		
XVI. SURGICAL CASES	510	162	10	682		
XVII. VACCINATIONS[2]	...	26	...	26		
XVIII. MIDWIFERY	...	...	...	...		
TOTAL	1124	1042	112	2278		

a. Hospital not yet opened.
b. ,, ,, ,, ,,
1. Comprises first three months only.
2. Number not counted.

Manchurian Plague Prevention Service

Medical and Nursing Staff, Plague Prevention Service, 1916.

東三省防疫之醫生及看護婦

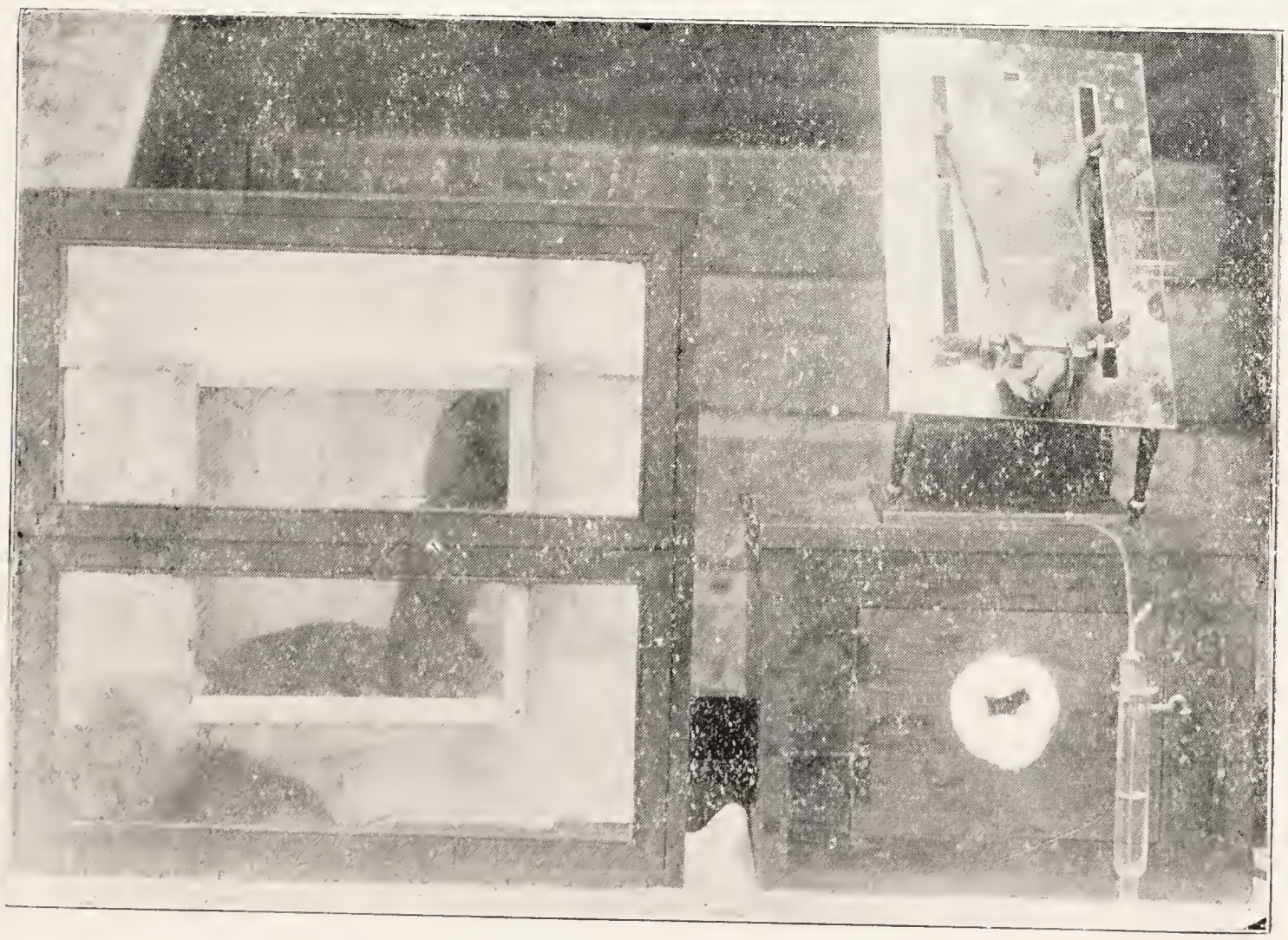


The Mukden Marmot (*Spermophilus Citellus*)
Its size is about equal to that of a rat.

奉天小旱獺〔地鼠〕其大如老鼠

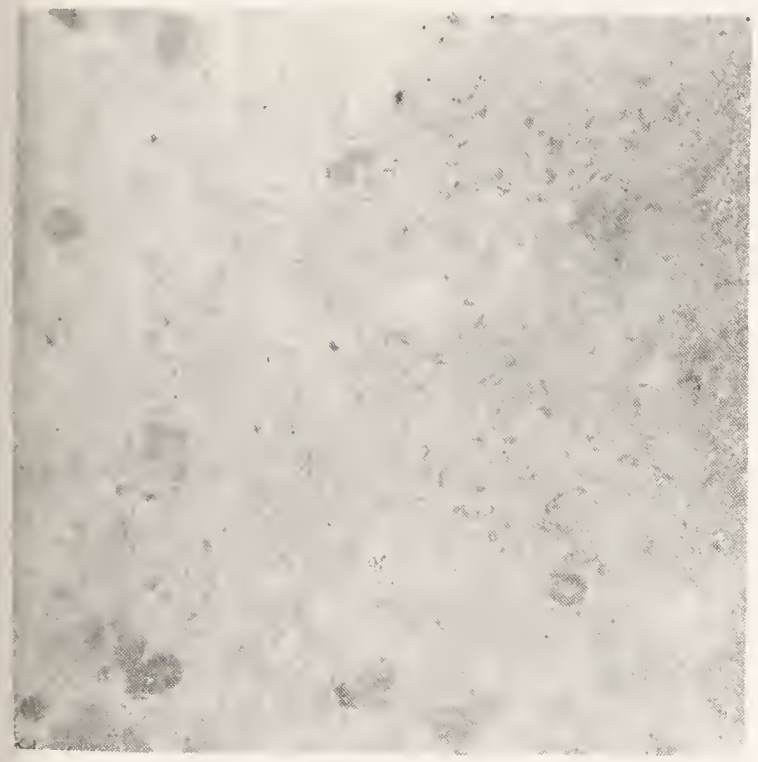
Drs. Wu Lien-teh and F. Eberson performing plague inhalation experiments in the open air, Mukden (1916).

伍伊二醫士在奉天試驗旱獺呼吸傳染鼠疫攝影

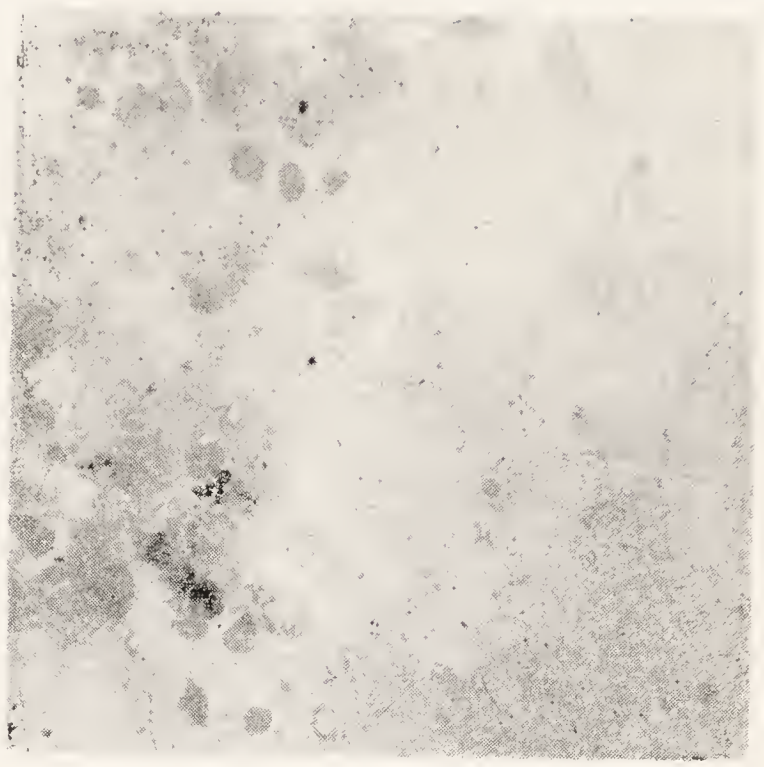


Apparatus used in the Inhalation Experiments.
(1) On left, a cage with a central gauze compartment.
(2) On upper right, a marmot tied down to receive spray.
(3) On lower left, wooden box for holding the marmot and stage. In front of this is the spraying apparatus.

旱獺呼吸試驗之儀器

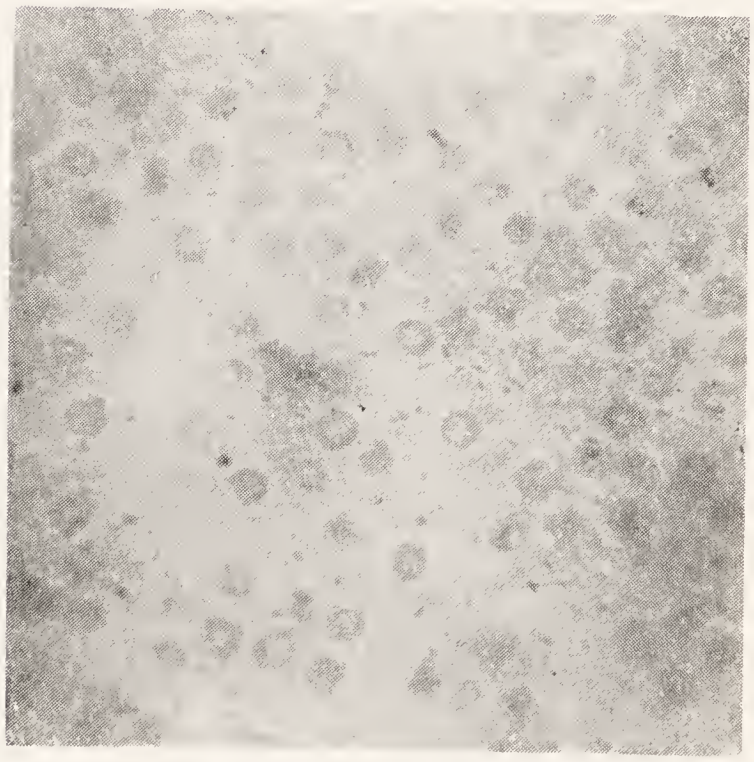


A. Film from contact marmot's spleen, plague inhalation experiment.
Note *B. pestis*.
× 850 diam.
器吸呼由染傳.脾之獺旱疫鼠於死
菌疫鼠意統杀



B. Film from contact marmot's lung, plague inhalation experiment.
Note *B. pestis*.
× 850 diam.
統杀器吸呼由染傳.肺之獺旱疫鼠於死

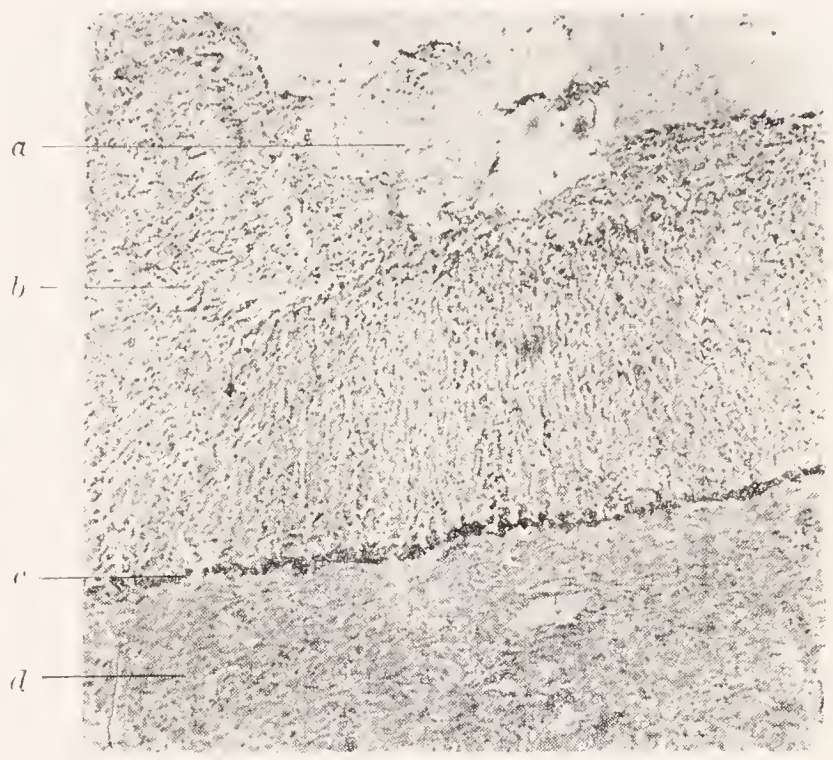
C. Film from contact marmot's liver, showing *B. pestis*.
× 850 diam.
.菌疫有現.肝之獺旱疫鼠於死
倍十五百八大放



D. Film preparation of heart's, blood of marmot, plague inhalation exp, showing *B. pestis*.
× 900 diam.
吸呼由染傳.血心之獺旱疫鼠於死
菌疫有現統杀

E. Section of marmot's stomach, after feeding on infected material
a. organised blood clot, showing *B. pestis* in substance.
b. glandular coat.
c. submucous coat.
d. muscular coat stripped off.
× 50 diam.

在菌疫血結凝有現面斷之胃獺旱
倍十五大放內其

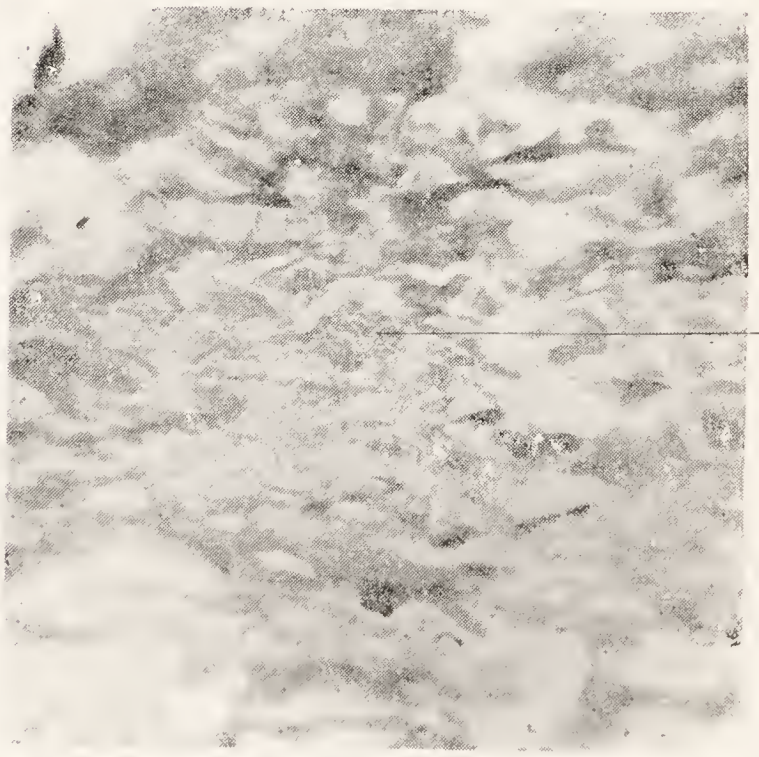


F. Section of marmot's stomach showing ulceration in mucous coat after feeding on infected material.
a. ulcerated patch containing many *B. pestis*.
b. glandular coat.
c. submucous coat.
d. muscular coat. Around blood vessels here are groups of *B. pestis*.
× 50 diam.

倍十五大放瘍潰有現面斷之胃獺旱

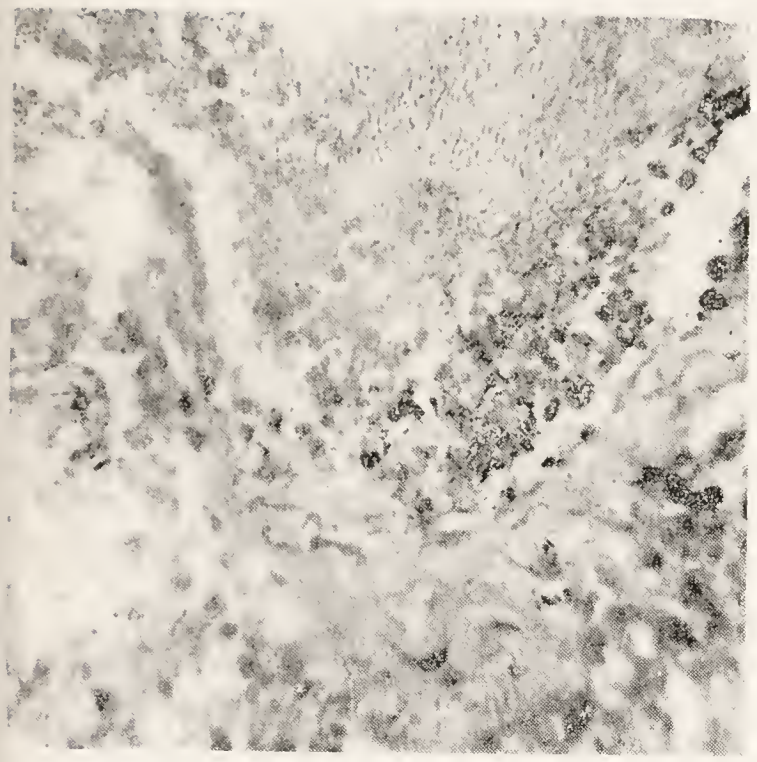
G. Film preparation from mucous coat of stomach of marmot, which died 4 days after feeding on infected material. Note the large no. of *B. pestis*.
× 850 diam.

統系器化消由染傳膜液粘之胃獺旱
數多菌疫在意注亡死日四第



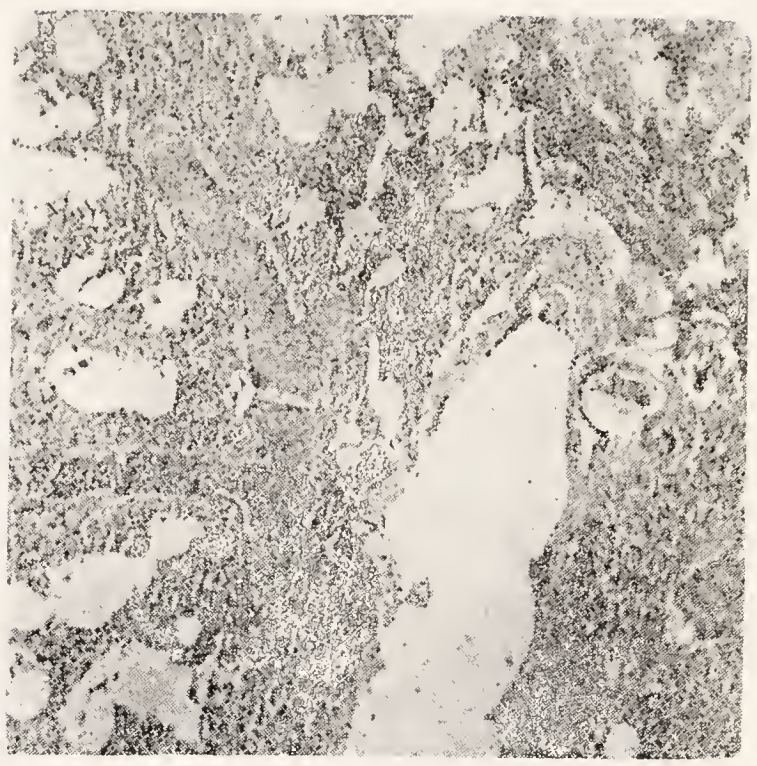
H. Section F. enlarged to show a group of *B. pestis* (*p*) in muscular coat.
× 900 diam.

疫菌堆一有現面斷之肉肌胃
倍百九大放部一之圖F上乃



I. Section from lung of marmot showing bronchioles choked with *B. pestis*. Plague Inhalation experiment. × 850 diam.

菌疫爲管支氣微細面斷之肺獺旱塞充所



J. Section from lung of marmot, after plague inhalation. Showing pneumonic patches. Note areas of collapsed alveoli. × 200 diam.

統糸器吸呼由染傳.面斷之肺塊炎肺有現

K. Nymph of a tick from Mukden marmot, *resembling Haemaphysalis konigsbergeri*. × 45 diam.

胎胚爪扒上身獺旱小於附

L. Flea from Mukden marmot identified as *Ceratophyllus famulus*. × 45 diam.

蚤跳之上身獺旱小於附倍五十四大放

Open Air Ward, Sansing Hospital, 1915.

三姓防疫醫院之通氣病房

New Hospital at Taheiho (Aigun), 1915.

黑龍江愛琿市之新防疫醫院

Hygienic Dining Table, with Food placed on Revolving Tray.

新式衛生餐檯

大夫偕同連德赴津調查醫治鼠疫方法時亦蒙天津海軍醫學堂借地居住俾便進行凡此種種均深感謝

(十三)本處各院醫官職員之去留

一　總辦兼總醫官伍連德英國干不離齊醫科大學最優畢業

二　會辦柯必達濱江海關稅務司

三　哈爾濱濱江醫院正醫官陳永漢英國干不離齊醫科大學畢業

四　濱江醫院專司檢驗疫菌醫官伊伯遜美國高崙布大學校畢業

五　三姓醫院正醫官鄧松年北洋醫學校畢業

六　大黑河醫院眼科醫官朱毓芬五月底告退

七　大黑河醫院副醫官林家瑞北洋醫學校畢業

八　哈爾濱濱江醫院副醫官林廷藩北京協和醫學校畢業

九　哈爾濱濱江醫院副醫官石冀良北京協和醫學校畢業

十　大黑河醫院副醫官胡世良九月底告退

十一　大黑河醫院女醫士陳守貞

十二　哈爾濱濱江醫院正看護陳則敬

十三　拉哈蘇蘇醫院配藥生武錫三

(十四)本年盧布價落雖屬太甚而各處醫院官職員終能勉力奉公盡心職守以重防務而京奉南滿各路又優與免費以便來往巡察及履行防務海關人員又類能盡力贊襄防務而當伊

接該醫生巴里來書道謝云如法防救大奏功效則本院防務幸已利及他省矣

（十一）專司檢驗細菌之伊醫生於本年六月二十八日派往美國各處調查鼠疫細菌以一年爲期給以美金一千元何士伯醫生自就黑龍江獸醫局之聘以來歷年資以醫治牛馬等畜成效頗著現屆三年期滿已於九月遄返美國矣本年五月十旬以俄國革命影響致土匪猖獗本處醫院女看護正陳氏被匪斬傷手部幸經醫治痊愈而女庶務曹氏慘被土匪殘殺當堂致命竊念本院開辦以來皆賴該女庶務相助爲理今慘遭兇禍以致喪身同人憫之經呈請大部酌予補卹蒙矜與准卹銀一千盧布業已遵示妥交曹氏親屬具領矣

（十二）謹將近年普通病人就診本處各院醫治人數逐年比較列表如下

年別 / 醫院別	哈爾濱	三姓	拉哈蘇蘇
民國三年	一九一六七	七五四八	一八三〇
民國四年	一九三九五	四一三九	一三三八
民國五年	一四六八七	三八九三	一二二二
民國六年	一〇六五二	三七四〇	一〇一八

年別 / 醫院別	大黑河
民國三年	七二三一
民國四年	七一七三
民國五年	六八四七
民國六年	六八四七

該院及該處成立不特京師病人就醫得所聲起全國人之觀感增其信仰西醫之心振興馬

（八）本年六月十三日 連德由哈爾濱出巡東三省北境等處各醫院於六月十七日到三姓二十日到拉哈蘇蘇二十五日到大黑河本年因河水淺擱故歷十三日之久乃抵大黑河所巡察各處醫院辦理俱有進步差堪告慰而大黑河之官商各界尤具熱心特踴躍捐資築成與醫院相接之馬路并設置路燈於人民之就醫該院者尤爲便利

（九）本年哈爾濱各處居民多來院陳請派員赴各該處化驗井水汽水牛奶戒烟丸等項以定其能否適用而哈爾濱縣知事亦請本院醫生以爲發給行醫准照之標准代爲考驗該縣醫生以爲發給行醫准照之標准查當時報考之醫生共十九名而合格者一人而已該地官民漸知衛生及信仰醫院亦人民常識進步之徵也而濱江一帶及俄國租界等處因歐戰影響物價雖日形昂貴而該兩地之新建築反日見增多濱江一埠尤煥然一新舊破房屋幾無存者因而松花江一帶之低地亦從而墊高以應時世之需要即此而地價日高現哈爾濱醫院之地價計可值五十萬云

（十）本年東三省北境各處全無鼠疫發生堪稱安謐惟哈爾濱黑龍江等處發生天花痘症不少而猩紅熱症間亦有之但萬不及上海之盛行而去年十月甘肅省近西藏一帶曾發生肺鼠疫該處英國醫生名巴里里者特請本院示以防救之法及應用藥品如法告之至本年三月

（五）

本年元月二十四日至三十一日各國僑醫組織之博醫會與中華醫學會開聯合醫學會於粵東省城時 連德 請假在粵以中華醫學會會長參與是會而東三省防疫各醫院中之醫官亦多有演說辭寄往該會宣讀及關於醫事之標本寄往該會陳列均極受該會歡迎而關於伊大夫與 連德 數年來研究肺鼠疫之經歷如前此醫界對於肺鼠疫一症祇知預防之法而無救治之方人或染之幾於束手待斃心焉痛之力加研究期發明一種新血清以爲注射冀收良效之演說尤爲赴會各醫生所注意循至今日研究又經數月益覺更有頭緒此種新血清將來或可望發明以拯救傳染肺鼠疫者則裨益世界人類當更不淺也

（六）

四年前美國人設立一大農業公司於黑龍江耕穫悉用新式機器嗣因該公司域內發生一種熱症蓋由一種大蠅嘬牛馬之身牛馬即因而生病致死當時莫悉其爲何病及應如何治法以致死傷牛馬不計其數而人亦有染是病而死者該公司束手無措愁然憂之當由本防疫總處即派醫官前往細加檢驗始悉爲惡性毒疽并從而研究其醫治之法得一種救治方法以告該公司該公司來書道謝云如法醫治救生人畜無算是防疫醫院之設於防治鼠疫之外更得以防治他種疫病不特有裨於人畜其於農業發達之補助亦不少也

（七）

本年中央醫院董事會陳請大部核准 連德 駐京籌辦中央醫院并陳請內務部轉請大部核准附設北京防疫處於中央醫院以 連德 兼充該處總辦數月以來籌辦就緒開幕在即將來

據卽院內職員亦屢以虧折爲言或且頓萌退志不急圖補救難以支持并請鈞部照會咨飭仍照原定兩數每年撥發六萬兩以資維持實叨　德便謹呈　外交總長

六年十二月二十五日

關於第二第三款外交部指令

迭據呈稱哈爾濱等處防疫醫院繼續辦理業歷五年請照商各國公使允將此項防疫經費於關稅項下定爲常款又此項經費原定七萬八千盧布係按華銀六萬兩計算現在盧布價落由一元二毫跌至一毫四仙今昔比較相差太遠請照商各國公使每年撥銀六萬兩以資維持各等語當經本部先後照會領銜公使轉商各國公使去後茲准領銜公使照復稱各國大臣允准將此項經費定爲常款於哈爾濱關稅項下按年如數劃撥惟此項經費之用途仍由海關隨時稽核此案雖經允准將來設因意外情形之必要時外交團仍有取消允准之權至此項經費改撥銀兩一節各國大臣顧及現下盧布價值異常漲發之際允行本年在該醫院所劃撥之款即可於七萬八千盧布改作六萬兩俟將來情形如何再爲酌奪各等因本部業卽分別咨行稅務處轉飭濱江關稅務司遵照辦理合行令仰該總醫官遵照此令

（四）

去年十二月　連德　請假前往香港參觀香港大學當時香港總督兼充香港大學總董極表歡迎且以　連德　歷年殫心研究醫學從事各種醫務不特中國實受其益世界各國亦深蒙其利特蒙贈以名譽法政博士同時受贈名譽博士者計有五人而以醫生獲贈者則　連德　一人而已

有備而他方均蒙其福關係豈等尋常爰此乞請
准將前情照會駐京領銜公使請其先行選派明達醫員前來哈爾濱等處防疫醫院調查辦理
是否適當允將海關此項銀兩定爲防疫常費以免按年請求種種阻碍倘嗣後各公使隨時欲
派醫員前來調查悉從其便更可互徵意見策勵進行庶地方防務無間斷之處而辦理手續亦
免阻難之處所有請將防疫機關定爲常設情形是否有當謹乞
察奪施行無任待命之至謹呈
外交部

（三）　前本處各院經費原由海關歲撥六萬兩當時祇以哈爾濱通用盧布故由兩數折合盧布每
年劃撥七萬八千盧布不意近年因歐戰影響盧布價格大落以致不特各種開消諸形竭蹶
即醫官職員亦多以虧損太甚爲言或且頓萌退志各處防務幾至不可支持自經 連德 具情
呈請外交部照商各國公使仍按照原定兩數年撥六萬兩既蒙核准東三省等處防疫事務
賴以維持
節錄本處呈外交部文
（前略）再查本處防疫醫院經費前蒙鈞部與領銜公使協商原定每年劃撥六萬兩祇以哈
爾濱通用盧布爲一時便利計遂由兩數折合盧布計年撥七萬八千盧布不意近因歐戰影
響盧布價落竟由一員二毫跌至一毫四仙今昔比較相差太遠以故不特一切開消諸形拮

民國六年九月十七日

東三省北境防疫事務總處第五年全年報告書

（一）此報告自民國五年十月一日起至民國六年九月三十日止

（二）東三省北境等處防疫醫院經費自蒙外交部照商各國公使允准定爲常欵於哈爾濱關稅項下按年如數劃撥凡本處各院之醫官職員等更可決心實力策勵進行不特東三省防疫及醫事從此可期日加進步而各省聞風興起於全國衛生醫務之前途亦大有影響也

民國五年十一月　日

附錄本處呈外交部文

呈爲請將哈爾濱等處醫院定爲常設照會公使團擇派醫員前來調查事竊自前清季年東省鼠疫盛行防止之後經各國代表聚集奉天開會討論均以防疫之舉重在瘟疫發生之時執行救治尤重在瘟疫撲滅之後從事預防遂經議決於哈爾濱等處籌設防疫醫院以資防範常年經費七萬八千盧布由於海關項下支撥創辦伊始未知後效每屆一年呈由大部照會駐京領銜公使徵其同意繼續辦理業歷五載按季按年已將辦理情形呈送在案不特地方日趨安謐而診治病黎信仰之心日且有加無已即各國亦無間言去年美國慈善團柔氏派員調查報告亦以本處辦法最爲適合但五年成效既已昭彰而臨時性質依然存在每滿一年必得外交團同意海關始能撥欵殊於辦理手續醫員合同諸多阻梗而在事人員常懷五日京兆有碍進行且防疫無殊兵備戰爭雖息整飭軍旅尤當認眞況瘟疫流行捷如影響一方

黑河醫院副官胡世良北洋醫學校畢業
黑河醫院女醫官陳林金釵福州石塔婦女醫院畢業
濱江醫院正看護翁蔣松筠福州石塔婦女醫院畢業
濱江醫院女庶務曹蕙卿
拉哈蘇蘇醫院配藥生武錫三

（十二）哈埠中俄兩界市政近大改良新修馬路交通漸臻利便當上年開辦防疫時濱江縣署一帶多係茅屋蝸居今則通衢洋樓高聳矣人民之生活程度亦日高一日蓋兩年來雖受歐戰影響殷富之商正得乘此時機而懋遷有無獲利或有更盛於昔日者在鐵路交界之處曠地範圍頗廣現均填平劃界拍賣多爲吾國人購買以備建築所有修路溶溝安設電燈等費卽由此項地價撥用並經自購修路軋機兩套一爲比國一爲日本明春開凍後馬路卽可接築直達醫院市政既漸改良衛生醫學必能與之俱進尤爲地方之福防疫以來南滿中東各鐵路醫員贊助之心拳拳不倦殊爲可感本夏在奉天試驗鼠疫英國施醫士臂助尤稱得力哈爾濱等處海關人員暨各官廳遇事更無閡隔而防疫處各人員尤能同心共濟致使防疫各醫院名譽益彰皆爲羣策羣力之效果則欲進取之心不免彌切深愿我政府對於辦理此項要政不囿偏隅而使全國普及則豈僅國家之福抑亦 連德 所愿効勞之日也

（十）連德與試驗員伊伯生先後在奉天暨濱江醫院研究鼠疫能從呼吸傳染得有証據頗多業經編製成稿緘寄英美兩國醫學各報登載謹具一分並粘影片附呈田鼠既可由呼吸得疫則與人共處鼠貓之類亦無不可由呼吸而爲瘟疫之媒介且田鼠更能由食物染疫並經檢查其身上所生八足蟲虫尤多於跳蚤亦能傳疫但此蟲虫查驗手續尚未完備因得以上數種試驗較前實有增進深冀一年之後克以究成強大抵抗力之血精則防治更有所資矣

（十一）醫官人員之去留

總辦兼總醫官伍連德英國干不離齊醫科大學最優畢業

會辦柯必達濱江海關稅務司

濱江醫院正醫官陳永漢英國干不離齊醫科大學畢業

濱江醫院試驗微菌員伊伯生美國高畓布大學校畢業

副醫官陸存煊五月三十一日告退

三姓醫院副醫官鄧松年北洋醫學校畢業

黑河醫院專門眼科醫官朱毓芬北洋醫學校畢業留法國專門眼科

黑河醫院副醫官林家瑞北洋醫學校畢業

濱江醫院副醫官林廷藩北京協和醫學校畢業

濱江醫院副醫官石冀良北京協和醫學校畢業

（八）

本年鼠疫之症幸均減殺卽香港印度亦不盛行東三省北境一帶更就滅絕屈計防疫六載於茲從無發現實爲人民絕大幸福近傳日本發生霍亂現已傳染一千餘人長崎地方居多業已遵告各醫院預防在案想該國執行衛生之責者必能速爲設法救止諒不至波及鄰國而使蔓延美國近亦新發一種小兒急癱流行性自紐約發生患者已有七千餘人死者居四分之一此種病稙尙未澈究眞實致無確切防治之法美國醫界現正積極考究必能發明以供醫界之參考

（九）

各醫院所診病人之數逐年比較表分列於左

	三姓醫院	大黑河醫院	拉哈蘇蘇醫院	濱江醫院
五年	一四六八七	七一七八	一二二一	三八九三
四年	一九三九六	七二三一	一三三八	三六八四
三年	一九一六七	七五〇四八	一八三〇	四一三九

以上比較之數住院養病者尙不在內濱江醫院本年住院者已逾五百三十八名尙因限於經費不能多與收容故所收多係外科重症有力自備膳費者據該醫院正醫官報告病人有從二千餘里不憚跋涉而來就診者信用之深亦可以見更有猩紅熱紅疹天花水痘腮腺炎熱症咳嗽之類又不能不爲收留以防傳染他如一種戰鬬毒傷之新治療法該醫院亦常施用

明年可以實行

（五）

松花江以北富錦縣地方墾場每值夏令發生劇病農人牲口屢嬰其害本年夏間特派獸醫何士伯前往調查業經報告前來與連德去年所查相同發生獸疔之原實係馬蠅之毒傳染近由江北俄國官廳贈送注射抵穢血精數百瓶以資施治深望民間得此挽救因信仰而生感覺漸知衛生之道則此病雖屬劇烈不難日見減少而撲滅

（六）

連德五月二十五日由哈首塗出巡各處醫院於六月一日抵黑河該醫院日有改良婦科亦見進步該醫院計有醫官兩員女醫官一員現又加派專門眼科醫員頗足以敷因應道尹王杜對該醫院極表佽助拉哈蘇蘇醫院去冬迄今暫派最先學習之配藥生武錫三管理頗有秩序在三姓醫院住三日督視修理一切事宜此次體察各地方人民信用各醫院之心有加無已差堪告慰旋於六月二十二日回哈

（七）

中華醫學會本年二月初七日起至十二日止在滬開第一次大會公舉連德爲會長本處各醫員均有演說稿投寄該會以資討論更有關於鼠疫傳染病由於東三省發生者種種標本緘寄頗多以與該會研究議決明年開二次大會指定粵東與博醫會同時舉行該醫會之組織不惟有益醫界且引起普通社會漸知醫學改良之效果爲強種強國絕對之問題故北京倡設中央模範醫院者踴躍輸將落成在即人民遇有傳染之症多能送入傳染病院無非信用新醫風氣已開之一證

東三省北境防疫事務總處第四年全年報告

（一）此爲第四年防疫報告自四年十月一日起至五年九月三十日止

（二）去年十一月 連德 請假六個月所有職務暫由濱江醫院正醫官陳永漢兼理於本年五月五日銷假照常視事

（三）試驗微菌博士伊伯生五月五日到哈該試驗博士曾充美國紐約醫科大學校教習學識經驗兼優現派專管濱江醫院試驗之事該試驗室新設電機俾各種試驗器血自能活動以施手術 連德 近此數月以來正在與該博士悉心研究製出抵力較強之注射鼠疫血精蓋鼠疫之毒具有特別異點不能急切卽有心得且哈埠尋覓田鼠之類以供試驗頗覺困難業已設法羅致

（四）陸存煊醫員在本處供職已經五載去年十一月給假前往印度遊學本年五月回哈後本埠通用羌洋價格日落較前僅值半數該醫官原得薪水二百盧布堅稱不敷事畜告退而去各人員亦據前情迭請彌補業蒙

鈞部批准平均按照各人員薪俸增加二成五於五月辦理在案朱毓芬醫員由北洋醫學校畢業出洋留學法國二年於八月十日到哈已往派赴黑河醫院專理眼科 連德 此次到黑曾與各地方官重商該處金礦工人多罹目疾必須就近設一醫院以救人命財產之損失希望

大黑河醫院副醫官胡世良北洋醫學校畢業
大黑河醫院女醫官翁蔣松筠福州石塔婦女醫院畢業
濱江醫院副醫官石冀良北京協和醫學校畢業
濱江醫院女庶務曹馮蕙卿
濱江醫院配藥生王國良
獸醫何仕伯美國人美國獸醫專門大學畢業本年正月到差雖屬本處所轄人員但經費爲
黑龍江官廳籌指職務亦專在該處各地方本處曾於去年詳定各醫官章程遵照辦理在案
副醫官陸存煊就職已歷五載例應准予六個月假期以資遊學啟程之期不遠曾經商告印
度京城醫學校到時俾便接洽

(十五)本處歷辦以來頗著成效實由各方贊助之力卽黑龍江朱巡按使黑河張道尹委聘獸醫之
舉於防疫亦有裨益凡由牲畜傳染之病隨時報告知更如中東鐵路俄國醫官南滿鐵路日
本醫官上海工捕局英國醫官呂宋美國醫官遇有聞知莫不卽舉以告而海關及本處醫官
辦事人員尤藉贊襄之效南滿及我國各路給予乘車免費券俾便交通更爲可感本處幸甚
地方幸甚

（十三）本處成立計已四載無日敢忘疫氣發生故關於治疫室消毒室各種應需器皿卽無日不預爲設備如兵家焉不可因無戰爭而廢操練際此平靖之秋以一院施醫尋常疾病實不但營救窮黎且足以借助防疫蓋平日受治者既有感激信仰之忱臨時自生言聽計從之效不至如前此諸多掣肘不易設施且西伯利亞沿路時有疫症纏綿故本處對於每年經費非常省節期有儲蓄以應不時之需庶有變不生恐慌重增政府擔負

（十四）醫官人員之去留

總辦兼總醫官伍連德英國干不離齊醫科大學最優畢業

會辦盧力飛四月十五日告假

會辦柯必達四月十六日接充濱江海關稅務司

濱江醫院正醫官陳永漢英國干不離齊醫科大學畢業於去年十二月十二日告退回國從軍

大黑河醫院副醫官陸存愷北洋醫學校畢業

濱江醫院副醫官鄧松年北洋醫學校畢業

拉哈蘇蘇醫院副醫官林家瑞北洋軍醫學校畢業

三姓醫院副醫官林廷藩北京協和醫學校畢業

濱江醫院計一萬五千三百九十五名
三姓醫院計三千六百八十四名
大黑河醫院七千二百三十一名
拉哈蘇蘇醫院一千三百三十八名
以上之數祇就來診者紀之更有海關及各機關人員由各醫官出診者尚不在內三姓拉哈蘇蘇兩醫院俄國軍商各界常來就診極表歡迎因該處無別醫院之故住在濱江醫院療治者計四百零八名其中多屬重大割症須施蒙藥者其他願住院醫治之人猶多以限於經費祇能平均日以四十五名爲標準每名每日祇收膳費二角貧而乏資者且予豁免

（十一）美國（柔氏芬特臣）大慈善會曾派數員以六閱月爲期在我國調查思所以佽助吾華醫學進步業經報告該會謂我中國辦理東省防疫及用人辦法最爲適當醫官因此不欲囿志偏隅思能稍爲擴充或可爲吾國醫學衛生兩者之末助

（十二）濱江警廳對於區域範圍之內所有死亡人數均能按季列册送來凡有傳染疾病亦時報告此雖警廳應辦之事尤屬防疫當急之務本醫院並時刊布傳染病原因淺說及著衛生醫學各問題付予各報各雜誌登載希望風氣漸開況防病之道婦孺尤貴週知故常遍告各醫官務須隨時演講多方指導俾知起病原因如何防備並鼓吹指導各學校擴張衛生功課俾人人有衛生知識庶爲醫員者能以全付精神執行醫務無庸分馳消毒看護瑣屑之舉

之疾病臟腑癰瘤防疫器皿圖畫影片東省覓出之傳病蚤蚊各虫類及提倡衛生建築物模型以資參觀者之考究

（八）

歐戰所受影響本處尤甚前者盧布九十六元可抵一十英磅現漲至一百四十盧布兼之藥物材料價值昂貴非常而本料尤爲本處大宗銷耗澎漲更鉅因疊遍告各院醫官極力撙節濱江醫院當時建築窘形湫隘今春本擬就舊址增築樓房覩此情景因之從緩進行以維經濟該院察驗室原聘英醫士雷諾士管理嗣因該醫士於去年十二月十二日告退回國從戎正向美國物色相當人物以充其缺

（九）

際此地方安謐癘疫不生固無直接疫務之執行然對於牲畜之傳染亦時不絕研究當本年六月間據富錦縣種植公司報告松花江以北牛馬之類斃者頗多且至波及於人連死三名更有一人正在危劇昇來濱江診治未經抵埠於前夜已故途中嗣經俄國醫士協同抬到本醫院解剖後旋以顯微鏡覘驗並注射其毒於專畜以供試驗之齧鼠身中確爲一種馬蠅叮咬所得卽吾國所稱獸疔之症此種馬蠅其毒甚烈常發現種植工場如患此病非急施手術卽恐不治業已函告獸醫何仕伯務於本年秋間親詣該處查驗詳報本院正醫官陳永漢亦正在將北方人民腸臟所生之虫考察以供研究前曾分飭各醫官加意尋捕各種傳病虫類業經檢送前來者類種頗多均已察驗明確俾漸佈知以資防備

（十）

第二年報告全書業將付鐫茲將本年各醫院所診病人之數列左

且本處各醫院遇變足以防衛瘟疫平時防備經驗之總樞尤關重要

（六）

醫官例於夏季出巡各處醫院以考成績本年七月五日首途前赴三姓拉哈蘇蘇大黑河等處巡視各醫院所有在事人員均皆勤慎醫務時有進步該處土人多籍滿洲風氣未開不知衛生關繫頻年丁天花癆症各傳染疾病之厄者甚夥曾經報告在案比者雖未盡改其習慣之性但與語及防病各方尚能動其傾聽據拉哈蘇蘇醫官詳告本年春令該處土人紀赫哲族魚皮韃子竟知陸續提携襁抱兒童百餘人前來該醫院受種牛痘此亦知識漸開之一證大黑河醫院增建隔離所業於本年夏告竣可以增容病人頗多該醫院現有醫官兩員因該處工人多籍山東時患目疾現派陸存煊副醫官前赴庫瑪各地方調查金礦中人罹此疾苦者勸其急就施治該醫官尚未查竣詳報前來如果該處官廳暨礦中各員司肯與贊助於生命財產豈日小補更派女醫官一員以便本年七月間改派女醫官翁蔣松筠接代療診婦嬰及查驗妓女此項經費係該處官警籌充

（七）

濱江醫院原爲各醫院表率辦理尤克逐漸增完備專備治疫之室現雖虛設然亦時飭整理以備不虞該醫院療治疑難病症日覺繁夥所施手術如剖腹理腦續骨割滌毒瘤惡疽等恙幾於無日不有對於熟病天花疑似傳染之症尤加特別注重察驗微菌以覘虛實故察驗室最爲緊要整理完備從未間斷博物室中陳列種種標本更與衛生大有關係如該院醫官剖出

丙東省所產傳言染疫之旱獺及其顱骨各標本
丁曾經試驗確能傳病之虫類如跳蚤蚊蠅各標本該數種虫類不特爲人之病媒而牲畜之屬
　亦時受其害
戊防疫所需各種器皿
己本處所著關於衛生防病各種論說圖畫册本
庚生理及傳染病之圖畫影片

以上種種標本不第醫界歡迎尤爲參觀者所注意當聚會時曾舉　醫官　演說提出問題爲喚醒國人固有衛生之良知更分三期爲公開演說會遴選三人擔任　醫官　亦在被選之列因歷舉辦理防疫事績及將來進行防範方針以圖促進國內衛生知識連日中西醫士研究發明新法聯絡感情交換知識甚爲誠篤現該會新組博醫衛生博醫教育兩部我國人亦得被舉爲職員現時我國醫界留學回國者爲數尚少甚願與旅華醫界聯合則醫學必有日底昌明之希望閉會後防疫各標本尚被假借傳列於各處博物室以供衆覽而資參考

（五）

本年二月間謠傳高麗交界之撫順臨江輯安等處發生瘟疫俄國日本各機關頗極注意時來探詢並經

內務部先後飭查在案實乃一種流行性猩紅熱病嗣後經日本醫官協仝我國醫官證明無異委非核疫惟各地方時有此種誤傳若非已設防疫機關消息靈通則市虎杯蛇必淆聞聽

東三省北境防疫事務總處第二年全年報告書

（一）此爲第三年防疫報告自民國三年十月一日起至四年九月三十日止

（二）去年十一月間接大黑河張道尹電咨承
黑龍江朱巡按使之命委託代聘獸醫醫員在各該處檢驗牲畜業於去年第二期年報呈明在案該獸醫何仕伯係美國人專門獸醫大學畢業於本年正月赴黑供職每年經費共計約需羙洋一萬元之譜均由該處官廳擔任該獸醫到差後分赴各處檢驗不辭勞瘁辦理頗臻完善牲口藉以免罹厲疫人民因之獲利無窮實爲地方一大公益

（三）去年十月間離海州里七十五里俄境哈拉諾地方發現核疫染者十六人死者十三人幸未蔓延未幾卽行消滅因而迴憶前淸宣統末年哈爾濱等處疫氣厲行亦在秋冬之交醫官時與中東鐵路各醫官討論防疫之舉極須杜漸防微未雨綢繆庶幾有備無患

（四）旅華西醫博醫會去年二月一日起至六日止在滬開會函約醫官前赴參預會場設有展覽會爲各處醫院陳列出產標本以資觀感特備一所供本處陳列歷年所有辦理防疫之標本茲略舉付諸該會陳列之重要者於左

甲解剖疫體各部之臟腑貯於玻裝之中者

乙疫體臟腑發驗在玻片之上以供顯微鏡之覘驗者

之人販運此藥輸入我國以除此大害也

（十三）駐哈各正副醫官除照常診病外常爲地方官化驗藥料及戒烟丸粉均能隨事贊襄施治新法深堪嘉慰近復悉心研究（挖沙猛）Wassermann 發明（九百一十四號）（藥數目）（泥惡沙羅挖先）neo-Salvarsan 新藥專治花柳之症吾國對於衛生雖漸知講究然多空言無補歐美各國皆注重醫學教育講求衛生無論公私學校均以此項編入課本所以上下社會貴賤婦孺均知衛生之理意美法良堪資趨步 連德常擬進行詳陳在案此次晉京已向教育部總長提出意見願擔任編輯數種衛生教科書呈送該部核定頒發各等公私學校編入課程已承允准俟編定後除呈送 教育部外另行呈 鑒庶衛生之教育普及家喻戶曉同躋康健强國强種均基於此更於九月間曾在交通部條陳車上衛生辦法九條經蒙採納通飭各站遵辦在案

（十四）去冬迄今南方各省及香港印度俄國日本美國等處均有疫症發現而東三省一帶竟無傳染是疫且自前清宣統三年舉行防疫之後計歷四年該地方均甚安謐厲疫不生藉堪告慰

（十五）我國鉄路及南滿鉄路各機關均以 連德所服之務不無裨益給予免票俾便周行甚感其優待雅意至於東省海關人員隨事助理毫無扞格而中東鉄路各醫員凡有所知均爲報告感情聯絡於此更見一班

大總統給予三等嘉禾章本年七月承
教育部保送復蒙
大總統任命爲學術評定委員會會員當
前清宣統三年東省時疫盛行之時 連德 曾派醫官
七員助理防疫事務均蒙
俄皇頒給四等寶星該醫官等之姓名履歷詳列於左

全紹卿現充天津軍醫學校校長
鍾清綏現充吉林官醫院院長
黎樹榮現充 大總統府醫官
方 擎現充陸軍部軍醫司長
侯毓文現在北京業醫
姚啓元現充奉天衛生醫院院長
鎮安上將軍行署軍醫科長
孫寶璐現充黑龍江官醫院院長

（十二）所轄各醫院就診病人其身上皮膚多受嗎啡針毒原其注射之法皆由於祇知圖利不計害人之販藥商人所傳授查本年吉林交涉局拘留所中犯人計六百一十七名而受注射嗎啡之毒者竟至三百零一人之多言之深堪扼腕現正與各地方官籌商設法除此流毒考前清宣統三年海牙萬國禁烟公會條約販運嗎啡本懸爲厲禁想各領事定能贊助禁止各該國

濱江醫院正醫官陳祀邦英國干不離齋醫科大學畢業生
正醫官現充濱江醫院助理研究徽菌事雷諾士厄丁布耳醫科大學畢業生
大黑河醫院副醫官陸存煊北洋醫學校畢業生
三姓醫院副醫官鄧松年北洋醫學校畢業生
拉哈蘇蘇醫院副醫官林家瑞天津軍醫學校畢業生
大黑河醫院女醫官葉陳秉瑞福州石塔婦女醫院畢業生
濱江醫院副醫官林廷藩北京協和醫院畢業生
濱江醫院女庶務曹馮蕙卿
濱江醫院女看護翁蔣月英福州石塔婦女醫院畢業生
濱江醫院首班配藥生常希曾
前拉哈蘇蘇醫院副醫官崔常山於六月十五日告退前濱江醫院副醫官劉億德於九月二十五日告退林家瑞原於四月十五日到差林廷藩於九月十一日到差即經先後派補該缺

（十）

各醫官自當勤慎奉公力行不懈現擬商之會辦盧稅務司改良變通各醫官薪水辦法並擬各正副醫官如果在該醫院克盡職務准於規定期間給予數月短假派往歐美各國副醫官則派往香港上海或印度以資考察期有所得

（十一）連德去年蒙

有二百人之譜傳染甚易蔓延所以委派女醫官駐於該處醫院專心診理張道尹壽增及地方各官均贊成實行驗妓辦法巡警局尤能捐貲一百五十盧布雙統領捐貲四十兩以爲該處醫院之補助曷勝告慰如果各地方均能觀感而推行則大黑河其嗤矣矣

（七）

茲將所轄各醫院由民國二年十月一日起至三年九月三十日止所診病人之數開列如左

濱江醫院一萬九千一百六十七人
三姓醫院四千一百三十九人
大黑河醫院七千五百四十八人
拉哈蘇蘇醫院一千八百三十人
以上各醫院所診病人屬於重大割症如檢取鎗彈剖縫內部瘤瘡之類者頗不乏人均多奏效

（八）

本處辦理防疫事宜曾以漢英兩文編成第一期報告書已於秋季報告詳明書中英文及繪影設色圖畫係英國（堪不禮處）大學印書館承印漢文係上海商務印書館承印該報告書極受歐美醫界報館機關等之歡迎

（九）

醫官人員之去留

總辦兼總醫官伍連德英國干不離齋醫科大學最優畢業生
會辦盧力飛濱江海關稅務司

（四）

連德　此次巡察松黑各處深知該處精於醫學者實難其人該地方士人均屬滿族因不知衛生之理致患天花癆癘肺病及各傳染症按年死者不少該處金礦工人多籍魯省秉質素强屢以患眼疾漸成殘廢者實繁有徒始因該工人等不明金礦淘沙易致眼疾之危險而政府又無完全保護礦工之策防患未然繼又不愼選良醫爲之診治及至喪明已嘆不及所以一抵礦場工作數月卽成瞽目者每年不下數百人此中利害實於生命經濟兩有關係近擬派一專門眼科醫官前赴該處診治然必該處地方官及礦場人員對於醫官有所指導如礦場應如何規定章程免令工人發生眼病及工人休憩寄宿之處應如何清理方不防碍衛生等竭力奉行庶能實收效果

（五）

滿洲地方牲畜之類多患傳染之症於衛生上頗有妨礙因該病可以傳及於人宜加注意且醫治牲畜亦可增人知識又可救濟農牧損失早擬聘一獸醫前往診視節經詳咨在案去年夏間當　連德　偕管理發驗徽菌事務之雷諾士醫官前往研究該牲畜血內寄生物時經與黑龍江巡按使及大黑河道尹議定聘請獸醫手續旋因的款無着中止致未實行良爲可惜

（六）

查驗娼妓爲愼防花柳毒之必要今得舉行於大黑河地方似爲中國所創舉查該處娼妓計

東三省北境防疫事務總處第二年全年報告書

（一）此爲第二年防疫報告自民國二年十月一日起至三年九月三十日止

（二）本事務總處原附設於濱江海關之內因該處甚形迫狹而海關辦公之室亦不敷用業經詳

陳

外交部核准另賃一屋以資辦公於五月十五日遷移秦家崗大道路東門牌六十三號

（三）連德於六月二日出巡松黑一帶所轄醫院三姓醫院去年六月間原已竣工開診嗣於本年六月十七日行正式開幕禮該醫院內容計分六幢可容病人六十每幢長六十尺寬二十五尺統計該地方圍二百六十尺四圍均護以一丈高之欄杆大黑河醫院去年十月間亦已竣工開診嗣於本年七月十九日經該處代理道尹蒞院正式開幕並有從俄國（巴拉哥嘯欠晤士忌）地方來之邊務司及該國官員與會該醫院建築共分兩層上層爲醫官住室下層分診療室徽菌室藥室割症室另有隔離所二座每座可容十二人更有零屋可爲看護生住室及存儲室冰房各用該醫院工程頗爲堅固基址均用青石砌成入土之基約深七尺經派男女醫官各一員常駐該院連德巡察已畢於七月三十一日旋抵哈埠

食也不籌更改之法卽此亦足顯吾國怪象著者雖極喜用國貨舉凡杯盤匕箸多擇中土物產極覺雅觀奈數年以來餐法不能不效西俗燕客固亦時用吾國肴品而食具必各人分認隨食隨換西人頗爲適意苟得俔廚妙手更足邀其贊嗜矣況擇可口者數品不必且多既不縻擱時間且不使人厭倦而傷胃口是歲春間赴滬參與博醫會有一美國醫士着令研究一法可以改良吾國家常餐食以重衛生勉强思之厥有一法頗稱簡便繪成一圖以供採擇法以一具方圓均可狀如大盤或木製銅製以能容四五盤碗爲度下裝一座愈低愈合可以旋轉每人各備一套食具各件盤菜另置一匙隨意拉轉將各匙引入座前個人食具而吃見者頗稱利便絕無傳染之虞並免沾染衣袖留意衛生者易試用之

衛生餐法

伍連德

習尙趨外一食之微亦必鰓鰓焉效之爲烹飪之術肴饌之美不若各國乎乃嘗於燕飮之餘西人多稱羨吾國烹調得宜或燔或炙均可適口先以美國而言已無處蔑有中國菜館標其名曰（雜碎）該國婦人尤覺欲炙（紐約）（舊金山）（支克哥）最大城埠亦有焉始建築華麗清雅宜人樂隊劇界尤爲主顧英國（倫敦）（麗佛普）（曼徹斯待）亦有焉吾國留學界之鄉味繼則該國名公巨賈亦時造嘗試以爲滋味鮮美較之英國有過無不及法京巴黎德京柏林亦如之開設於各國尙得西人所嗜美則在北京上海廣東各省珍錯自更畢備五味尤必調和而西人之垂顧者竟不數覯果何故歟是必有道而阻泥之北京菜館之陋習以極不雅觀最見汚濁之廚房建設於出入必經之門首其餐棹油以黑色不時整理粘膩薰蒸令人一望而生厭光復後多就改良棹上鋪以白布座中亦甚潔淨而上海廣東各處尤臻美備樓座高敞清雅不亞西人開設隨可邀集西賓不若從前之慮其譏誚雖然對於食法尤缺衛生吾國相沿習慣或匙或箸均直接往返由於公衆食物盤碗之中最爲惡習家常便食尙屬無妨若與賓朋生客聚讌何能詳悉座中之有無疾病苟患癆病花柳疔毒喉症口瘡爛牙顴骨流膿等恙立可傳染言之實堪畏葸毋怪西人從幼卽講求衛生不敢隨波趨俗同此共

必增七分之一。方能與用血液者同時致死。卽此試驗內標準鼠與試驗鼠相較。便可瞭然。如標準之鼠經鹽水毒注射。則鼠死更速。其餘一切病狀與未經鹽水注射者相同。蓋液面所遺之疫菌。自能增毒之利害。使血中毒而速死也。

就此種液毒而根究敵染。或能稍易。蓋此法已得疫菌中重要質也。司氏用不烈之生菌爲敵染之用。則甚危險。不若此液毒之便利。蓋疫菌入身血後其活動最不可靠也。鼠之血液。與人同。吾人當借鼠以研究一最完全之敵染血清。現正在進行之中。俟有成效。當再布告焉。

鼠	重量	毒劑	血液培養期	結　果
1	342 瓦	0.2 瓦	5 點	二十點死於急性之疫各內部及血均有菌
2	305 瓦	0.2 瓦	22 點	二十八點死與前同
3	510 瓦	0.1 瓦	5½ 點	四十四點死與前同
4	576 瓦	0.1 瓦	5½ 點	七十二點死驗與前同
標準鼠				
1	344 瓦	0.1 瓦	菌與鹽水相合無培養期間	活
2	250 瓦	0.1 瓦		活
3	348 瓦	0.2 瓦		活
4	372 瓦	0.2 瓦		活
5	380 瓦	0.3 瓦		第五日死
6	305 瓦	0.4 瓦		第三日死

此試驗證明鼠疫之菌用血液培養。（即液毒）則其毒至烈。如代以鹽水則其毒減。犖其分量

鼠	量重	毒劑	結果
1	243 瓦	3.0 瓦	不暈微現病狀三十六點死皮下之靜脈腺大而炎脾褰浮腫血中無疫菌
2	237 瓦	2.5 瓦	不暈微病三十六點死死後驗與第一同
3	267 瓦	3.0 瓦	不暈不現病狀三十六點死死後驗與前同

在此試驗。死鼠身內雖驗不得菌。而未死時確現有中毒之狀。可知血液與菌經過之時間增久。則能使疫菌就滅。出毒更烈。殺人至速。中毒之症狀。卽與微暈相似也。

試驗五。用二十五滴之培養基。灌以一瓦之鹽水。每〇。五之疫菌對以二瓦之血液。以培養之。培養期完。則置之離中具搖之。去其下所有之渣滓。使菌復浮於鹽水之面。復注射之于腹膜中。

鼠	重量	毒劑	結　果
1	198 瓦	1.5 瓦	不量一日死死後驗無菌
2	227 瓦	2.0 瓦	不量三日死內部菌甚多
3	276 瓦	2.5 瓦	不量四日死與第二鼠同

菌雖加多。亦不能得微量。如秦氏所云。惟此次試驗內有數鼠未死之時。雖不見量。而呈不快之狀。故第四試驗復將疫菌與血液相合之時期增加。

試驗四。用二十四滴之培養基灌以一瓦之鹽水。與九瓦之血液相合。在攝氏熱度三十七度經過十六點鐘。置之離中具。搖二點後乃用之。

此而力薄。

試驗二。用十八點培養基之鼠疫菌。灌以一瓦之鹽水。再與一瓦之血液相合。經過五點半鐘。後注射之如前。

鼠	重量	毒劑	結果
1	310 瓦	2.0 瓦	不軍四日死血與內部均有菌
2	365 瓦	2.5 瓦	不軍五日死死後驗與前同
3	295 瓦	1.5 瓦	不軍五日死與前同

可知疫菌與血液經過之時間雖增。久毒亦不加烈。故第三試驗將疫菌加重。

試驗三。用兩份二十四滴培養基之菌。各灌以〇·五之鹽水。再與六瓦之血液相合。經過五點半鐘。後注射之。

此試驗之目的。卽期由鼠疫菌造秦氏所謂液毒質。(Prototoxin)期能以之注射動物。生有敵染之力。但其結果終不能得微量如秦氏所言。且所試之動物均死於鼠疫。死後檢驗血與內部均有鼠疫之菌。似血液被搖後。所留浮面之餘菌。加以有機物。則其毒更烈。如秦氏所云。

試驗一。用二十四滴培養基之鼠疫菌與十五瓦特鼠血液相溶。經過三點半鐘後注射于鼠之靜脈內。

鼠	重量	液毒劑	結果
1	432 瓦	1.0 瓦	不量七日死血與內部均有菌
2	411 瓦	0.5 瓦	不量死
3	423 瓦	2.0 瓦	不量第六日死驗與第一同

在此試驗內液毒劑由零五至二瓦注射之鼠身上均不量。惟菌與液經過之時間甚短。或因

腺　項上與脉道之腺無大影響。

胃　醫學者常謂鼠疫之病不能由胃侵入。然就第三連試驗之所得。蓋有四旱獺由食道傳入菌發病致死。死後驗其胃均發炎。于胃口及十指腸尤甚。而紅塊及受傷處尤明。泗膜變毒異。膜腺發炎。四圍出血。間現有瘍痕。蓋以滲出之血液有數處瘍壞更大。胃腺之細胞腫而炎。甚有破裂者。腺中覓菌甚多。而壞處尤甚。下層泗變厚。腺之血管飛漲。充滿血脉。裏層肌膜亦積血。疫菌甚多。肌絲漲。

鼠疫之毒與毒力

鼠疫之病劇且烈。雖有預防之術。而無療治之方。此短篇之試驗。蓋專注于敵染力。爲後來研究治療之表率焉。

傅氏言如取動物血液與鼠疫疫菌相溶合。（因血液中有補助質。）則能得一劇毒。(anaphylato 種之動物身中。能使動物暈倒而死。秦氏言如預用輕量之毒使動物染之。僅有微暈。則動物能容納是毒。或液毒不至暈死。又此液毒有攻伐之力。如與有機物體相合。（如小腸炎之菌類。）種之人身則血中菌而死。

試驗旱獺傳染鼠疫之利害。當以此爲最早。而此試驗中尤以喂哺毒菌。證明食道傳染爲最有趣。至於呼吸傳染試驗之所得。則與人得此病者相同。茲簡敘之。

肺部（一）急性之疫。（指得疫二日至五日卽死者。）肺部之脈管近於肺膜處多白血輪。間且出血或縮小。气管則充滿泗液。間塞疫菌。圍於發炎之气管。間有肺炎之處。气窩與豗間有疫菌。（二）緩性之疫。（指傳染後十二日方死者。）其肺則與前所述稍異。出血與積血之處均少。肺炎之塊亦少。气脬則潰壞甚大。气管炎而厚。疫菌較之急性之疫亦少。

肝（一）在急性之疫。肝則紅色枯槁。細胞濁而中空。多嵗胭。肝靜脈澎漲。豗亦然。時有出血之處。（二）在緩性之疫。肝之變壞則不同。中葉之靜脈不甚澎漲。出血之點亦少。惟大部份肝之細胞中空甚至胞核消滅。故非默頂（色名）染不成色。疫菌之檢查增難。

脾　脈管積血。急性較重。慢性較輕。疫菌在急性亦較多。脾質變大。

腎　與肝同。在慢性所受之影響較之急性爲重。腎包微厚。腎球腫。在慢性其細胞常變壞消滅。滲血尤多。

心　心肌微腫。肌痕更顯。因之彈性力少而易斷。

獺之靜脈管。則旱獺於三十六點鐘疫死。死後驗血與各部均帶疫菌。喂者二。於第三日死。未經檢驗卽爲喂者三所啖。喂者三於第四日死。胃膜炎。各部微積血。胃中菌甚多。用各部及血抹之培養基則生菌。

試驗二。取旱獺三。喂之以急性疫死旱獺之肺肝脾。

喂者一。於第二日死。肝脾均積血。胃膜及腸均炎。抹之培養基得菌。喂者二。於第四日死。肝脾大而積血。抹之培養基得菌。喂者三。活至十四日而殺之。殺後檢驗各部無病。惟胃膜微有舊病之跡。用各部抹之培養基亦不得菌。此鼠於一星期前。蓋已吃過疫死旱獺之內部物一次焉。

注意

此連雖短。亦足證明旱獺能於食物上傳染疫病。因旱獺得疫死後。常被其同類所嚙也。由食道傳染者。病期約四日。雖多服毒劑亦不能促其死。死後最有分別者。卽食道之膜常發炎。至肝脾各部則與受異樣傳染而死者同。至於各鼠之抵抗力亦各有不同。於第二次試驗之第三旱獺卽可證明。

顯微鏡檢驗之所得

處潮濕。皆能增此病之傳染力。就此連被注射七旱獺中。五個于四日至六日中死於疫。其比例蓋爲百之七十一。與注射旱獺接近之旱獺有九。有注射後二十四點與之接近者。有四日後方與接近者。于接近後。第四日至六日之間共死其七。其比例蓋爲百之七十七。即此可知此病之潛伏期甚短。並注射旱獺發生傳染力甚早也。死後身體之檢查。蓋與人同。疫菌由气管直抵肺部。發生病區。乃由病區入循環系。致全身受毒。最注意者。即各部份之變更。肺爲最甚。炎而積血。肺膜上並蓋有血腥絲。脾與肝常變大。气管常炎。而項上與腋道之腺則否。顯微鏡檢驗之所得。雖肺之受毒最深。然其餘各部亦均受影響。脾與肺關係尤密。有中疫毒死。死後而驗無疫菌者。亦有受疫病至死。而內部尚未見有何變動者。蓋體弱毒烈。致死之速。在其內部變異之先也。最須注意者。即鼠中有漫性之鼠疫菌。其病期能延長九日至十二日之久。在此期內均有傳染之力量。於此病之傳染利害。最有關係焉。

(二)食物傳染之試驗

試驗一。取旱獺三。喂之以五十六點疫死旱獺之肝脾。

喂者一於第三日死。脾肝均積血。胃炎。肺肝脾血抹之培養基均生菌。用此培養基注射於旱

此次試驗與第一連第二次之試驗所得畧同蓋有所注意者卽各旱獺之抵制力有不同也於此四旱獺中三個得猛烈之疫死而第四個與其同受注射共處一籠乃竟不得疫縱所注射之毒劑不能決其無遺漏之處然間接受染之第一者且得急烈之疫而死而第四者直接受注射乃不得病可知其抵制力之强矣

試驗三　注射二旱獺三日後再置二旱獺與接近

接近一於五日死肺炎肝脾大气管炎抹之培養基得疫菌接近二第六日死肺積血脈管飛漲抹之培養基得菌

注射者一于第五日死肺炎尤甚肝脾大抹之培養基得菌注射者二于第六日死狀與前同

試驗四　注射二旱獺第四日置二旱獺與同籠

接近一二均活至十六日

注射者十五日死肺無變樣脾微壞用血心肺肝抹之培養基均無菌

注意

就第二連之試驗卽知肺鼠疫在旱獺由呼吸傳染甚速而人類亦與之相同密接同居與居

第二連試驗　因欲察明旱獺平日混合穴居傳染之利害故有此第二連之試驗使接近之旱獺與注射旱獺同處一籠不使其有一簾之隔

試驗一　注射二旱獺二十四點後置接近三旱獺於同籠

接近一於第五日死肺炎肝脾大積血腎大而炎气管亦炎取肝肺及血抹之培養基均生疫菌而脾所發尤多接近二後十二日死後察如前狀培養基之發菌以肺爲最多接近三亦於第十二日死死後驗如前

注射者一於第三日死肝脾俱大而積血種之培養基得菌以所種之培養基注射於旱獺之靜脈管內則於二日卽死注射者二於第九日死內部腫大積血均帶疫菌

試驗二　注射二旱獺二日後置接近二旱獺于同籠

接近一於第四日死肺炎脾肝大而積血气管炎抹之培養基生菌甚多　接近二于第六日死死後驗如前狀肺脾疫菌甚多

注射者一于第五日死肺尖炎肝大而質壞脾微大气管炎抹之培養基則發生疫菌　注射者二活至第十七日殺之驗內部無病抹之培養基亦不生菌

注射者一於第五日死於肺疫肝大脾積血腎炎頂上之腺大抹之培養基得疫菌無數注射者二於第七日死肺炎而積血肝大脾炎出血以心與脾抹之培養基均無疫菌惟肺有多數之菌注射者三得疫七日死

試驗五　注射三旱獺置籠之中劻至第三日置無病之旱獺二於劻之旁隙

結果　接近一第三日死肺炎各部無病種之培養基無疫菌接近二第七日死於鼠疫肺炎各部均受病抹之培養基得疫菌

注射者一於第五日死兩肺俱炎肝脾俱大腎炎而積血气管亦受影響抹之培養基得疫菌用脾血抹之育菌最多注射者二於第七日死各部均積血脈管漲甚抹之培養基得疫菌無數注射者三於第七日死死後驗與第二同

注意　此第一連試驗證明肺鼠疫在旱獺傳遞甚速且能轉傳於他旱獺就第五次試驗即知旱獺於注射後二日即有傳染之力又使病旱獺另房而居則傳染增難即被注射之十二旱獺內八個於第三日至八日之間得至重且烈之肺鼠疫而死即此接近之旱獺三死而七免故死之比例在直接注射而染者百之六十六在間接接近者百之三十

抹之培養基亦無疫菌。

在此試驗內。宜注意之點。卽接近之四旱獺第一個七日卽死。較之注射死者尙早五天。第二個至十二日方死。第三四個與其同處一房。乃不得疫。可知旱獺之抵抗力。各有不同。於人亦然。其傳染之力量亦常異。

試驗三。注射二旱獺置籠之中。劻。第二日。置無病之旱獺二與同籠。

結果。接近二旱獺。活二十二日均不得疫。

注射旱獺一。於十日死於疫。內部均發炎。肝脾變大。抹之培養基均生疫菌。注射旱獺二。活二十二日無病。

在此試驗內。有注意之點。卽注射旱獺一所得之疫。係緩性非急性。於十日後方死。與普通鼠疫於三日至六日內卽死者。有不同焉。

試驗四。注射三旱獺。置籠之中。劻。與試驗三至第三日方取無病之旱獺二。置之劻旁四圍之空地。使之接近。五日後又隔離之。

接近者一。於十五日死。肺炎。肝脾俱大。抹之培養基得疫菌。接近二。活二十二日不得疫。

亦甚要緊。必緊壓其頸使其鼻向上。有完全之呼吸。而後注射乃能直入气管。

第一連試驗。用五滴帶菌培養基。

置已注射之旱獺於一籠內。籠約大一尺九乘一尺五乘一尺八與無病之旱獺相隔一壁。或隔以屏。

試驗一　注射二旱獺。同日置接近二旱獺於籠。

結果　注射旱獺二均不得疫。至二十日殺之。察各內部均無病。

接近旱獺一于十二日死。肺炎而積血。脾肝俱大。取血種之培養基無疫菌。接近旱獺二至二十一日殺之。驗無病。

試驗二　注射二旱獺。同日置四旱獺接近相隔以屏。

結果　接近一于七日死。肺炎。肝大。脾脆。气管炎。取內部抹之培養基。發生疫菌。用此培養基種之無病旱獺則發生鼠疫。至四十八點死。接近二于第十二日死。各部均有病。肺尤甚。肺膜及气管發炎。用內部抹之培養基生疫菌。接近三四。後二日死。驗無疫菌。

注射旱獺一。於十二日死於鼠疫。抹之培養基生疫菌。注射旱獺二。於十八日殺死。各部無病。

小旱獺（奉天名地鼠）傳染鼠疫之研究

伍連德
伊伯遜

旱獺傳遞鼠疫。自一千九百十十一年東三省發現時。卽有持論及之者。當時學者雖指旱獺爲傳遞之媒。要皆無實據。至司氏證明用呼吸法能使旱獺得鼠疫。吾人乃信旱獺爲傳染此危險病中之一重要物。從事研究。今以吾試驗之所得。更證明旱獺得疫蓋由气管與食道二路。故研究時亦分呼吸傳染之試驗。與食物傳染之試驗二種。

按所用以試驗之小旱獺。卽 (Spermophilus citellus) 奉天最多。常出沒於墓地。狀似常鼠。長爪利齒。用水灌其穴。則跑出。得之甚易。

（一）呼吸傳染之試驗

用二十四滴有菌阿膠培養基。對十瓦鹽水。傾于有分量之帶嘴玻璃筒內。而噴之。噴點細如微塵。直向無病小旱獺之鼻孔注射之。

第一連試驗用十滴。雖所用之分量有定。而噴時不免有遺漏之處。萬不能全數射入鼠之气管。又注射之前必用藥將小旱獺鼻孔四圍之皮膚擦淨。注射之後亦必淨去所有頭上之餘點。以免疫菌侵入皮膚。致與由呼吸道傳染相混。而旱獺之位置

緒言

本書集四年之報告而成而此四年中外受歐戰之影響內因政潮之起伏本處防疫進行頗滋困難之感而其最著者厥有二端一則盧布價落也本處經費向由海關歲撥七萬八千盧布不謂歐戰以來盧布時值竟由一員二毫跌至一毫以下其竭蹶爲何如二則物價澎漲也本處各院所需藥品用具率由東西各國輸入乃歐戰以來百物騰貴或相倍蓰或相十百或竟至無從購買職此二因而本處歷年力加撙節以爲癘疫發生時特別用度之蓄者以盧布之價落亦竟至十不值一焉可慨也至楮墨印刷價均奇昂而爲省節計本報告書亦祇擇其大者重者發刊其稍可從略者略之間亦有詳於英文而略於中文者則取史公互見之例抑本報告書所紀載其中與醫事有關者多經刊行於本國及英美各國雜誌中以期與世界熟心研究醫事者互相印證吾因之有厚望焉我國西醫日形發達近年以來畢業於中外者不下數千其熟心研究醫術者正不乏人當更能因利乘便隨時研究多所發明以與世界各國醫學專家爭雄競長而爲我國醫界大放光明也是書之成深感濱江醫院正醫官陳君永漢之攸助而秘書楊君子毅亦間參與譯事焉

總辦兼總醫官伍連德

民國六年十二月初二日

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